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ABSTRACT

This unit, one of a series designed to develop and foster an understanding of the marine environment, presents marine science activities for second grade students. The unit, focusing on awareness of living/non-living factors shaping life of the sea, is divided into sections dealing with: physical characteristics of oceans; fish; sea anemone; barnacles; starfish; crabs; hermit crabs; limpets and chitons; clams and oysters; oyster drills and moon snails; seaweeds; ecological interactions; beach activities; and responsibility of the individual to protect the ecology of ocean life. Each section has a student text with related activities. Each student text is preceded by a teacher background section containing hints on how to use the section, additional information, and items requiring advanced planning. Each activity is preceded by a teacher background section providing additional information about the activity, including teaching hints and answer key for activities. Important vocabulary words/terms are listed in the teacher background sections; they are underlined in the student text. Activities are designed to enhance reading as well as investigational skills; several activities provide practice in mathematics skills. Although all activities can be modified to suit individual needs or be used "as is," it is strongly recommended that they be performed along with the readings/discussions found in student text material. (JN)

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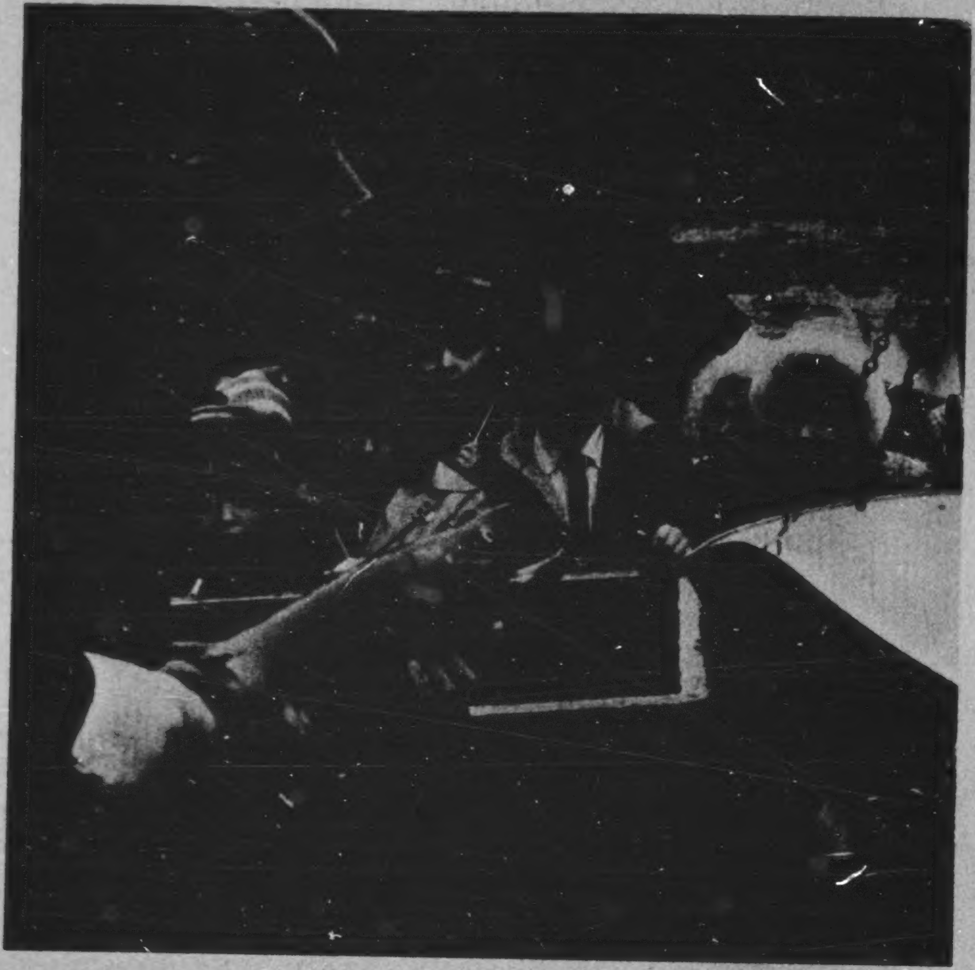
2 MARINE SCIENCE ACTIVITIES



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MARINE SCIENCE ACTIVITIES

GRADE TWO

MARINE SCIENCE CENTER
MARINE SCIENCE PROJECT: FOR SEA
Educational Service District 114
Poulsbo, Washington 98310

ESEA TITLE IV-C
James A. Kolb
Project Developer
Author/Editor

MAY ALL CHILDREN LEARN TO LOVE THE SEA

MARINE SCIENCE ACTIVITIES - THE MARINE ENVIRONMENT - GRADE TWO

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MARINE SCIENCE ACTIVITIES

GRADE TWO

INTRODUCTION

The history of the United States is strongly tied to the seas. The future of the United States will also be strongly tied to the marine world. It is important that the leaders and the citizenry alike have a familiarity with the marine environment that will permit them to make wise choices in resolving the conflicts that are sure to arise over use of the ocean's resources. Marine Science Activities is designed to contribute to the knowledge necessary to make these sound decisions. In the development of the Second Grade Marine Science Activities, our goal has been to provide an opportunity for both the teacher and the student to become aware of the living and non-living factors that shape the life of the sea.

This unit has been designed to be used in its entirety or just in part. It is recommended that the teacher incorporate his or her own ideas, experiences, and background to elaborate the subject material. It is important to develop the natural enthusiasm children have for learning about the sea. This is the time to add a bulletin board dealing with the marine world to your classroom. Displays of living and non-living marine creatures are also recommended. Use your imagination to create an exciting classroom atmosphere. National Geographic magazines are excellent scources of pictures. Incorporate some of the books listed in the "Children's Books about the Marine Environment" section into your reading program. Investigate the audio-visual materials available from your supplier. Have students bring in their shell collections and other related items. This unit has the potential for not only being worthwhile, it can be fun!

The unit is divided into several sections. Each section has a student text and student activities. Each student text is preceded by a "Teacher Background" section which contains hints on how to use the section, additional information, and items for which advanced planning is required. Each activity is also preceded by a "Teacher Background" section. This section gives additional information about the activity including teaching hints and answer key. The "Teacher Background" section for the first unit, "Oceans", includes directions for vocabulary activities which can be used to teach and reinforce the terminology introduced in the units that follow. Skim the contents of the unit to discover the organizational scheme. Please read the text and activities before you use them.

The materials have all been prepared with ease of duplication in mind. Please feel free to duplicate any and all materials you need to effectively utilize this unit with your class. Important vocabulary terms are listed in the "Key Word" section of the "Teacher Background". They are also underlined in the text. The words are defined in the text, either directly or by context. All of the units have activities accompanying the text. Most require few materials. It is strongly recommended that the activities be performed along with the reading and discussion of the text. The activities are designed to enhance reading skills as well as investigational skills. Some activities provide practice in math skills. The activities can be modified to suit your particular needs but will work well "as is".

The unit can be incorporated into the variety of laboratory experiences using live animals and related equipment provided at the Marine Science Center. In addition, the teacher is given the opportunity of inservice assistance with the unit as well as the opportunity to use the many resources available through the Marine Science Center staff. Our staff is available to you to give assistance in providing resource material and in setting up the unit of study. Please contact one of our staff members by calling (206) 779-5549.

At the end of the text and activity section, you will find a send-in page. We would like you to use it to let us know how much you liked or disliked the unit. If you have some marine activity that you have tried successfully with children, please let us know about it. Perhaps we can incorporate it in future revisions.

This unit is one of a series designed to develop and foster an understanding of the marine environment. Other units in the series include:

Marine Science Career Awareness	Grade 4
Marine Science Activities — The Marine Environment	Grade 6
Marine Biology and Oceanography	Grades 7 - 9
Marine Biology and Oceanography	Grades 9 - 12

Marine Science Activities Grade 2 has been prepared with funds from ESEA Title IV-C Grant Number 35462 administered by Educational Service District 114 and the Superintendent of Public Instruction.

James A. Kolb
Project Developer
Author/Editor

A CONCEPTUAL SCHEME FOR MARINE AND COASTAL ENVIRONMENT STUDIES

BY MAURA BEENS TYRRELL AND ROBERT W. STEGNER

1. AN ABUNDANCE OF WATER MAKES THE EARTH UNIQUE IN OUR SOLAR SYSTEM.

- 1.1 Water has a unique combination of chemical and physical properties.
    - 1.11 The chemical and physical behavior of water results in part from the geometry of the water molecule.
    - 1.12 Within the range of temperatures encountered on earth, water exists in three states: solid, liquid, and gas.
    - 1.13 Water exchanges large amounts of heat as it changes in state.
- 1.2 Water in the environment contains a variety of substances in suspension and in solution.
    - 1.21 Water is a very effective solvent.
    - 1.22 Dissolved and suspended substances affect the properties of water.
    - 1.23 Water in nature usually contains gases, organic compounds and mineral salts.
    - 1.24 Many elements dissolved in water are recycled through biological, geological, and chemical systems.

2. AQUATIC ENVIRONMENTS INTERACT WITH THE EARTH AND ITS ATMOSPHERE.

- 2.1 Most of the earth's water is in the oceans.
    - 2.11 Oceans formed early in the history of the earth.
    - 2.12 The earth's surface water is constantly recycled through the oceans.
- 2.2 The ocean waters are influenced by the earth's rotation, revolution, and position in the solar system.
    - 2.21 Ocean current patterns are affected by the absorption of solar energy.
    - 2.22 Ocean current patterns are affected by the earth's rotation.
    - 2.23 Tides result from gravitational forces of the earth, the moon, and the sun.
- 2.3 Energy is transferred wherever bodies of water meet the land or atmosphere.
    - 2.31 Atmospheric movements generate waves, surface currents, and coastal winds.
    - 2.32 Moving water shapes land forms.
    - 2.33 Subsurface topography is constantly changing.
    - 2.34 Land and sea floor movements generate waves.
    - 2.35 The aquatic environment helps to stabilize the earth's climate.

2.4 Materials carried from land masses influence the physical and chemical features of rivers, lakes and coastal zones.
- 2.41 Water, ice and wind carry minerals, nutrients, sediments and fresh water into rivers, lakes and coastal zones.
- 2.42 Fresh water from the land dilutes the coastal water.

3. AQUATIC ORGANISMS INTERACT IN COMPLEX ECOSYSTEMS.

3.1 Life probably originated in the marine environment.
- 3.11 Water facilitated the chemical evolution of organic compounds and coacervates.
- 3.12 Chemical evolution resulted in heterotrophic systems.
- 3.13 Autotrophs evolved from heterotrophs.
- 3.14 Aquatic environments have supported the evolution of a diversity of species.

3.2 Aquatic organisms are adapted to their environments in different ways.
- 3.21 Aquatic organisms are adapted developmentally, structurally, functionally, and behaviorally to their environments.
- 3.22 Organisms in aquatic communities interact in balance with their environment and with one another.
- 3.23 Populations of aquatic organisms are unevenly distributed.

3.3 Aquatic ecosystems depend on a constant flow of energy and the recycling of materials.
- 3.31 Energy for the maintenance of aquatic ecosystems comes from the sun.
- 3.32 Aquatic plants convert solar energy to food energy.
- 3.33 Aquatic organisms transfer energy and materials through food webs.
- 3.34 Aquatic bacteria reduce organic materials to simpler forms.

3.4 The stability of aquatic ecosystems tends to be directly proportional to the diversity of their populations and the complexity of relationships among them.

4. PEOPLE ARE PART OF AQUATIC ECOSYSTEMS.

4.11 Aquatic environments have affected the course of history and the development of human cultures.
- 4.11 Oceans, lakes, and rivers have served as routes for the dispersal of human populations and cultures and for commercial transport.
- 4.12 Proximity to aquatic environments and the availability of aquatic resources have influenced the cultures of many societies.

4.2 People's activities may alter the aquatic ecosystem.
- 4.21 People collect and culture aquatic resources.
- 4.22 Exploitation of aquatic environments can cause depletion of many marine and freshwater species and the degradation of habitats.
- 4.23 People are changing aquatic ecosystems by adding pollutants to land, to air and to water.

4.3 Existing technology is capable of maintaining the health and usefulness of aquatic ecosystems.
- 4.31 The maintenance of the health and usefulness of aquatic environments depends on value judgments and ethical considerations.
- 4.32 Regional and international agreements will be essential for the conservation of aquatic resources.

MARINE AQUARIA IN THE CLASSROOM

From kindergarten to graduate school the marine aquarium arouses interest and enthusiasm. Traditionally, marine aquaria have been very expensive and difficult to operate. The recent technological improvements have reduced the cost and labor involved in maintaing a marine aquarium. Teachers should give every consideration to the establishment of a marine aquarium in the classroom.

Before embarking on a marine aquarium project, some basic questions need to be resolved. These include: How much can I afford (do I want) to spend in time? in effort? A very simple set-up to keep hermit crabs can be had for a few dollars while an elaborate temperature-controlled aquarium can cost thousand dollars.

Regardless of the type of aquarium chosen some facts pertain to all:

1. Aquarium tank - use only tanks made from all glass, plastic, epoxy-coated wood, or fiberglass. No metal edges. While a 10 gallon aquarium may be used in some cases, 20 gallon size is the preferred minimum.
2. Sub-gravel filter - a good sub-gravel filter should be employed to help control biological wastes.
3. Air pump - you can seldom have too much air. Get a pump with a capacity high enough to effectively run the sub-gravel filtration system.
4. Gravel filtrant - use dolomite, crushed coral rock, or crushed oyster shell. Builders gravel has iron and similiar materials which will harm or kill marine organisms.
5. Thermometer/Hydrometer - tools useful in determining the salinity and temperature of the water.
6. Seawater - Synthetic sea salts may be used to make salt water solutions if you are more than a day's drive from natural seawater.
7. Food - Depends upon the type of organism. Use only high quality foods and remove uneaten food from aquarium.

If you buy a marine aquarium kit, instructions for set up will be included. Otherwise, a few hints are given below:

1. Talk to people who have had marine aquaria. (e.g. other teachers, pet shops, etc.) Their assistance can be invaluable.
2. Place the aquarium in desired location. Away from direct sunlight but near an electrical outlet.
3. Install sub-gravel filter.
4. Wash gravel in tap water. Spread evenly over the filter.
5. Fill tank with correct amount of water needed to make sea salt solution (follow directions of manufacturer). Or fill to 1 or 2 inches from top with natural sea water if available.
6. Run filtration system for 24 hours to mix solution.
7. Shut off filter. Check specific gravity by floating hydrometer and reading it at the water-line: it should read between 1/021 and 1.023 when the water temperature is 68-77° F (20-25° c). If necessary adjust by adding tap water to lower reading.
8. Run filter for 14 days. Some aquarists recommend placing one or two hardy specimens in the tank for this period. If available, hermit crabs or the like should be added to help condition the water.
9. Add specimens to tank. If you order the animals from a biological supply house they will come with directions. Otherwise, open each plastic bag of specimens in subdued light and float it on top of the water in the aquarium for 15 to 30 minutes. In this period trickle water from the tank into the bags to slowly equalize temperature and salinity. This is the crucial step. Now add animals to tank, one at a time. (If animals act nervous or contract, stop operation until they have adjusted.)
10. The specimens will live several months without being fed, but to keep them healthy adopt a simple, regular feeding program. Feed carnivorous invertebrates (sea anemones, crabs, horseshoe crabs, starfish, etc.) once a week: they take small minnows, shrimp, earthworms, bits of lean beef. Filter-feeders (barnacles, hydroids, sea cucumbers, clams, etc.) eat Daphnia, brine shrimp, algae, protozoa, or dried fish foods. Herbivorous species (sea hares, sea urchins, turbo snails, etc.) may be fed lettuce or spinach.

Avoid water pollution--remove all uneaten food.

Once the system is operating, care is easy. Each day, a person familiar with the aquarium should check filters and specimens. Dead animals must be removed at once. Add tapwater as often as necessary to keep water at level marked. Do not add salt water since this will increase the salinity.

Though sea-salts don't disintegrate, specimens will stay healthier with partial water changes at regular intervals. Suggestion: once a month, add a few gallons of new seawater solution after siphoning off same amount from tank.

For algae control, scrape tank walls every two weeks.

The above suggestions apply to all marine aquaria. If you live in a Northern latitude, and want to keep local cold water species, you will need a refrigeration unit of some description. Instructions for home-made units can be found in reference books on marine aquaria. Ready-made refrigerated aquaria are available and expensive.

If after reading the above, you are discouraged, take heart. Hundreds of teachers are operating successful in-class marine aquaria. The technical problmes can be overcome. If you feel that it is unquestionably "out of your league" and you cannot obtain help from another source, do not completely forsake the idea. A simple aquarium for hermit crabs can be set up for a very few dollars. Solicit donations from students--all glass aquaria are plentiful. Go to a pet shop and buy a hermit crab or two and get instructions on how to keep them alive. It can be fun! At the very least, set up a freshwater aquarium with goldfish or tropical fish so that you can use a living example when you talk about aquatic organisms. Here is a real opportunity to use all that creativity that got you into teaching in the first place. Good luck!

RECOMMENDED READING

James, Daniel E.	Carolina Marine Aquaria. Carolina Biological Supply Co. 2700 York Road, Burlington, North Carolina 27215. 1974 This booklet is avilable from the above address and offers valuable assistance as well as information for single organisms or complete kits. 24 pages. ($1.00)
King, John M. and Spotte, Stephen	Marine Aquariums in the Research Laboratory. Aquarium Systems Inc. 33208 Lakeland Blvd. Eastlake, Ohio 44094. 1974 Describes tank set up and maintenance as well as offering experiments which can be performed using marine aquaria. Also advertises Instant Ocean products. 39 pages. ($2.00)
Straughan, Robert P.L.	The Salt-Water Aquarium in the Home, 2nd edition. A.S. Barnes and Co. New York 1970. A comprehensive reference. 360 pages. ($12.50)

(10)

CHILDREN'S LITERATURE OF THE SEA
TEXAS A&M UNIVERSITY

A SELECTED BIBLIOGRAPHY OF CHILDREN'S LITERATURE OF THE SEA

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September, 1978

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OCEANS

TEACHER BACKGROUND - Oceans

"OCEANS" Introduces the student to the marine environment. This section emphasizes not only the extent of the ocean but also its depth and the characteristics of the surface and the floor. Start this unit with enthusiasm - it's contagious. Provide your students with ample pictoral aids. If you have a marine aquarium begin to relate the marine environment in its natural state to the artificial marine environment in the aquarium. A world globe is helpful to show the location of the world oceans.

Duplicate the text pages. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. The "Key Words" should be taught if they are unfamiliar to the students. The activities included are designed to reinforce the concepts introduced. The reading level of the text is such that second graders should be able to read the material with little difficulty. Some students will undoubtedly need more assistance than others. You may also elect to read the work orally to your class.

Coloring worksheets follow this and many other teacher background. They are for reinforcement. They should be used after the text has been studied.

Several of the sections provide masters for preparing overhead transparencies. These masters can also be used to prepare additional coloring activities.

In addition to using the overhead transparencies provided, the following are suggested uses of the overhead projector with this unit:

1. Place animals directly on overhead and let them move across the stage (crabs are great).

CAUTION: Prolonged exposure to the intense heat may be fatal to the animals.

2. Place glass jar containing animal on overhead--observe tube feet, tentacles, etc.

3. Place layer of sand on overhead. Let crabs walk across it. Examine the tracks.

4. Use overhead to compare sizes (silhouette).

5. Use with glass container to observe wave motions.

CAUTION: Do not allow water (especially salt water) to come in contact with the overhead projector.

6. Use to show how filter feeders move water. Add a small amount of food coloring to the jar of water containing the filter feeders.

KEY - Text questions

Oceans

1. The answer depends upon your location. Probably the Pacific Ocean. A world globe is helpful in conveying the geography of the oceans.

2. The color of the ocean may come from the tiny creatures that live in the water or from the clouds in the sky.

3. You might find icebergs floating in the coldest oceans.

The Ocean Floor

1. Plants cannot grow in the deepest parts of the ocean because of the lack of light.

The Ocean Surface

1. The top of the ocean is called the surface.

2. Wind blowing against the surface of the ocean makes waves.

This section, like all of the others, contains a list of "Key Words". These are words which may be unfamiliar to your students. Be aware of these words as you progress. The words are defined, directly or by context, in the text. Science, in general, tends to be heavy in new vocabulary. Marine science is no exception. Many of the activities included in the following sections are designed to reinforce new vocabulary. Reading comprehension depends upon vocabulary development. Eldon E. Ekwall, has some recommendations.* Writing about vocabulary development he states:

Before a student can be expected to comprehend adequately he must develop a vocabulary sufficient to deal with words on the level on which he is expected to read.

A. Whenever new words come up in lessons, stop and discuss them in sufficient detail so that all students develop a concept of their meaning.

B. Appoint a "vocabulary committee" to preview each new lesson prior to class reading to select all words for which they do not know the meaning. Use these words as a guide to the new vocabulary along with the new vocabulary given in the textbook.

C. Develop picture files for each unit in the students' textbook. Use the pictures to develop the meaning of new words and concepts. These pictures may be placed on a bulletin board or simply shown and discussed as each new unit is introduced.

D. Place pictures on the bulletin board and have students try to find as many words as possible to describe the pictures. If students are able to use a thesaurus, allow them to do so. Place the words under the picture and discuss them every so often.

E. Develop "word awareness" by showing students how often we tend to skip over words for which we do not know the meaning. Promote awareness of new words by getting students to look for new words that they or other students may not know the meaning of. Write the new word the the student who found it beside it.

Carlos's new word--idealism

Frank's new word--afterthought

F. Encourage students to use "vocabulary cards." As students read assignments or any other reading material have them search for new words. When a new word is found have them write it on a vocabulary card. Then have them write it in the sentence in which it was used and underline the word. Encourage use of meaning context. After they complete their reading, have them look the new word up in the dictionary and write its meaning. Then file the new vocabulary cards in a shoe-box and review them periodically.

The amount of vocabulary drill necessary depends upon the particular class. In addition to the activities incorporated into the unit you might want to use one or more of the following ideas to develop vocabulary skills in the marine science area.

VOCABULARY ACTIVITIES:

CATCH

Words are printed on the chalkboard or on a chart. The teacher throws a ball to a child who pronounces the first word in the list. If the child can read the word, he throws the ball back to the teacher. If he cannot read it, he passes the ball to the next child, who says the word if he can.

TRAVELING

Word cards are prepared from words in the reading section. These may be placed inside a box which is to represent a trunk or luggage. The first child takes a card and says, "I am going on a trip and I will take ....(word on card). "She places the word card on the board ledge. The next child draws a card and says, "I am going on a trip and I will take........(word on card) and .... (word previously drawn)." The others take their turn.

HOME BUILDER.

A house with an incomplete roof is drawn. Cards are made to represent the shingles. A word is written on each shingle. The child reads the word and puts it on the house. If the picture of the house is tacked onto a bulletin board, the shingles may be stuck on with pins or thumbtacks. If this is not possible, small pieces of scotch tape may be used. The house may be outlined for bricks in a similar way.

BALLONS

A clown picture is drawn on the board or on paper. Draw an equal number of balloons on each side on the clown. Print a word on each ballon. A set of colored circles represents the balloons. There should be the same number of circles as balloons. On each circle a word which corresponds to a word on one of the balloons is printed. To play the game, shuffle the circles and take turns reading the words on their circles. When a word is read correctly, the circle is placed over the balloon with the same word. They may be fastened with plastic tape. Each player tries to cover balloons on his side of the clown first. If a player gets a word not contained in the balloons on her side, she must put it on the other side. The player wins when her balloons are covered.

KEEPS

Words from the reading are on cards. One child holds the cards in front of the class, showing one card at a time. He designates which child is to pronounce the word. If that child can say the word, he takes the card.

BASEBALL

Word cards with one word printed on each are shuffled. Divide students into two teams. A scoreboard is made to record the number of runs. A baseball diamond is drawn on paper, on the board, or on the floor. Markers are needed if the game is played on paper or the board. A spinner numbered 0 - 4 is used. One child from each team spins to decide which team is up first. Highest number goes first. Each team member in turn spins the spinner and draws the number of cards indicated by the spinner. If the player spins a 3 she draws 3 cards. If the player can successfully read all three cards, she moves to third base. If the player can only read 1 of the 3 cards, she moves to first base. If the player spins a 0 it's an out. Three outs and the other team is up. If a player advances to a base already occupied, it automatically advances the player on the base to the next base.

FOOTBALL

A football field is made of cardboard. Words are printed on cards. The ball is placed on the fifty-yard line. The first player reads the word on the first card. If he reads the word correctly, he goes back ten yards. When a child crosses the opposite goal line, his score is six. If he reads the next word correctly, he adds the one extra point to his score.

PLAYING CARDS

Words are printed on 2-by 3-inch cards which are placed face down on the table. The children take turns drawing cards. When a player takes a card she reads the word printed on it. If she reads it correctly, she keeps the card in front of her. If she cannot read it, she returns the card, face down, to the bottom of the center pack. The child with the most cards wins.

MATCHING WORDS AND DEFINITIONS

Place slips of paper with the vocabulary words printed on them, in envelopes. Place a larger second set of slips with a definition for each word in the envelopes also.

Students each take an envelope and empty it out on their desks. They should then place the word slips in a column in numerical order.

1. breakers

2. iceberg

They then try to match the definition slips with the words. The definition slips should have a number that corresponds with the word slip; however, the number should appear only on the back. This way students can check on the accuracy of their work when they have finished. Number each envelope and give students a number sheet corresponding to each envelope. Have them check off each number as they do the words in each envelope. This way each student will be sure to do each envelope.

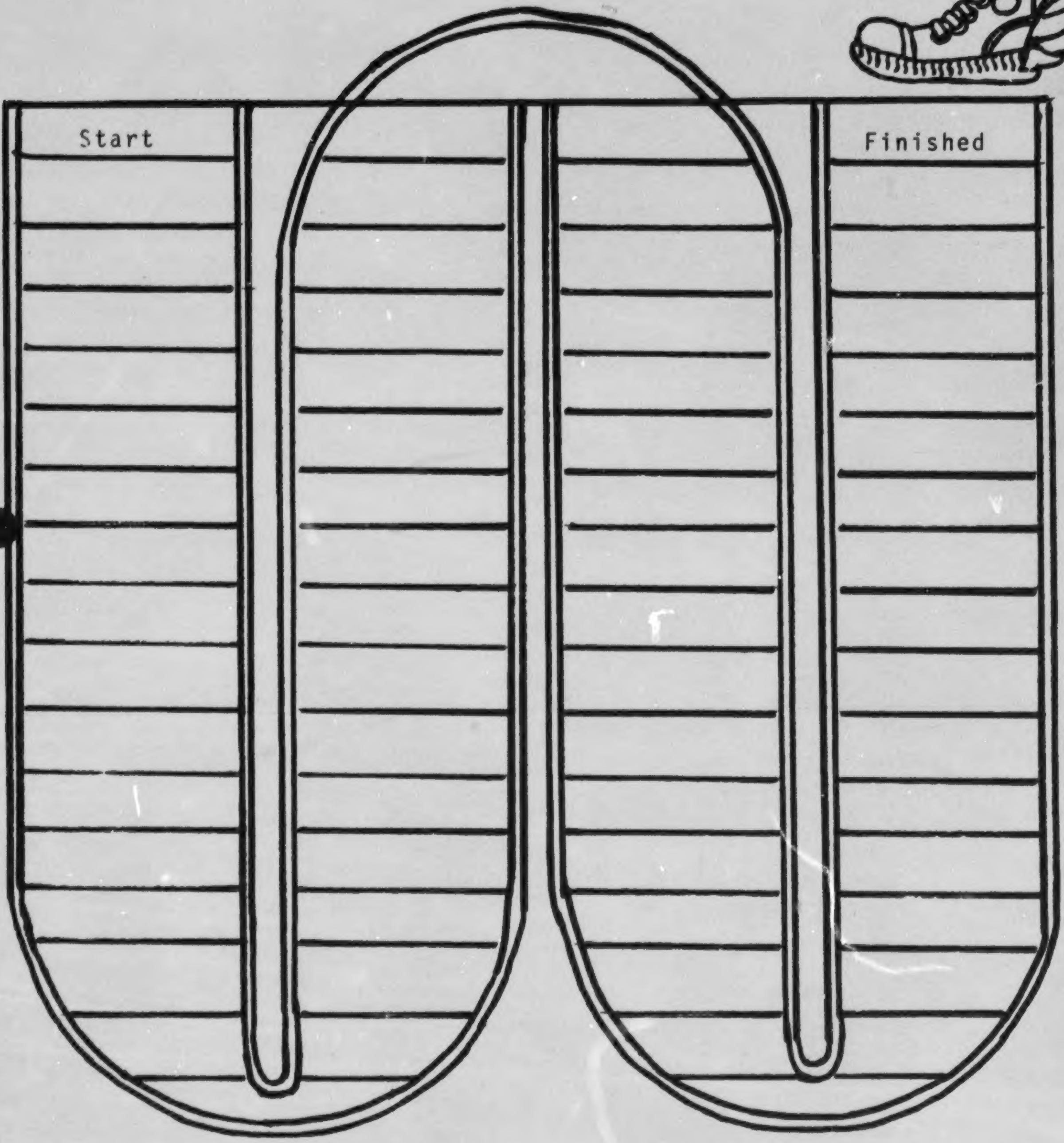
GAME BOARD FOR VOCABULARY DEVELOPMENT

This game board can be used to reinforce vocabulary simply by duplicating the game board and filling in the blanks with vocabulary words. This completed game board then becomes the master game board from which a class set can be duplicated.

Directions for Play:

1. Markers can be made from colored paper. The game can be played by two to four players.
2. The player spins a spinner or throws a die to see how many spaces to move.
3. The player moves to that space by reading aloud each word along the way.
4. If a word is missed, the runner has fallen and must go back to the last word he read correctly.
5. The first one to the finish line is the winner.

NOW WATCH ME FLY

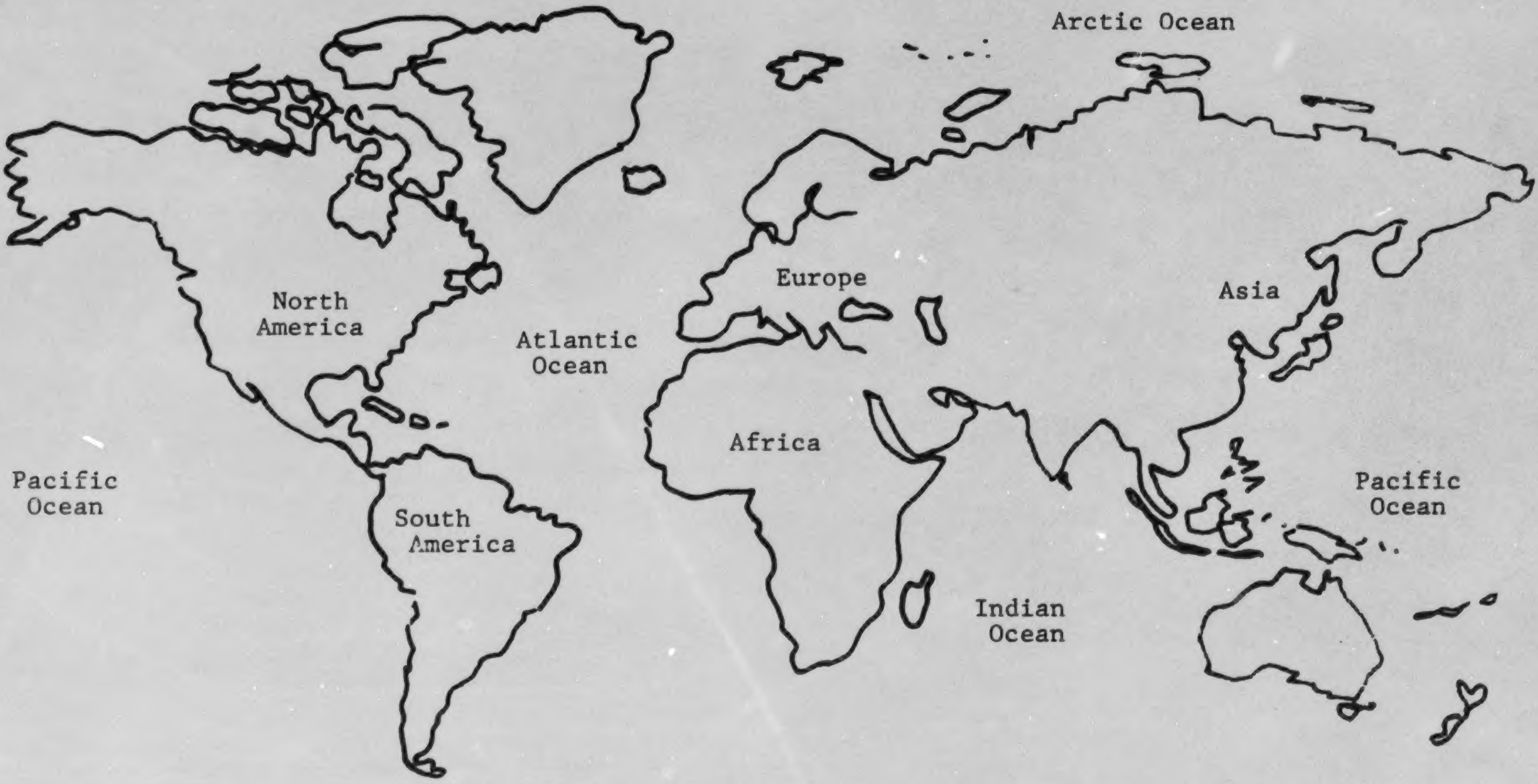

Start
Finished

KEY WORDS

Africa
Atlantic
Artic
Asia
bodies
bottom
breakers
creatures
deep
Europe
floor
iceberg
Indian Ocean
mountain
North America
oceans
Pacific
salty
shades
South America
sunlight
surface
valley
water
white cap
wind

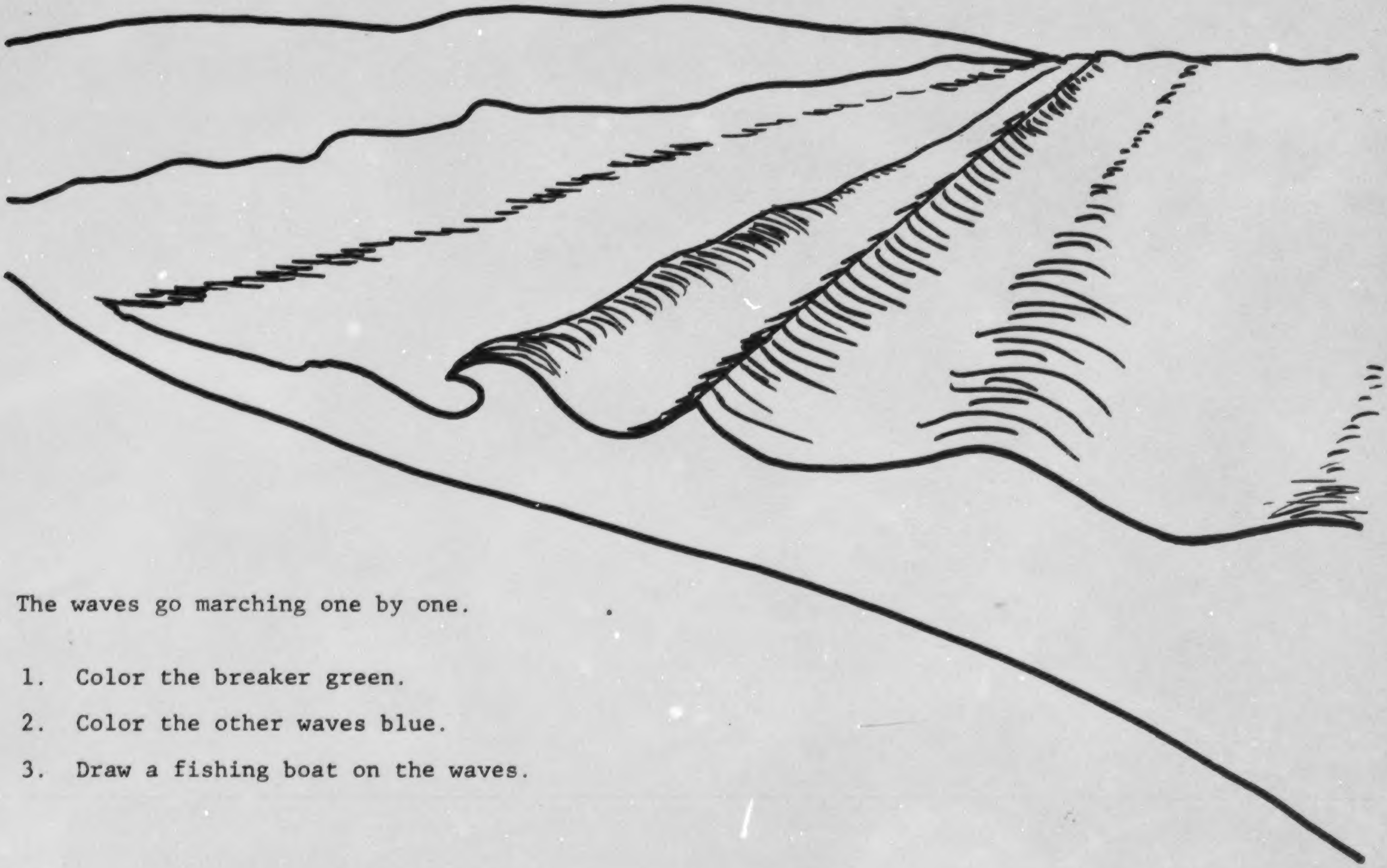
*Ekwall, Eldon E. 1977. Locating and Correcting Reading Difficulties. Second Edition, Charles E. Merrill Publishing Company, Columbus, Ohio. 169 pages.

oceans


Arctic Ocean
North America
Europe
Asia
Atlantic Ocean
Africa
Pacific Ocean
South America
Pacific Ocean
Indian Ocean

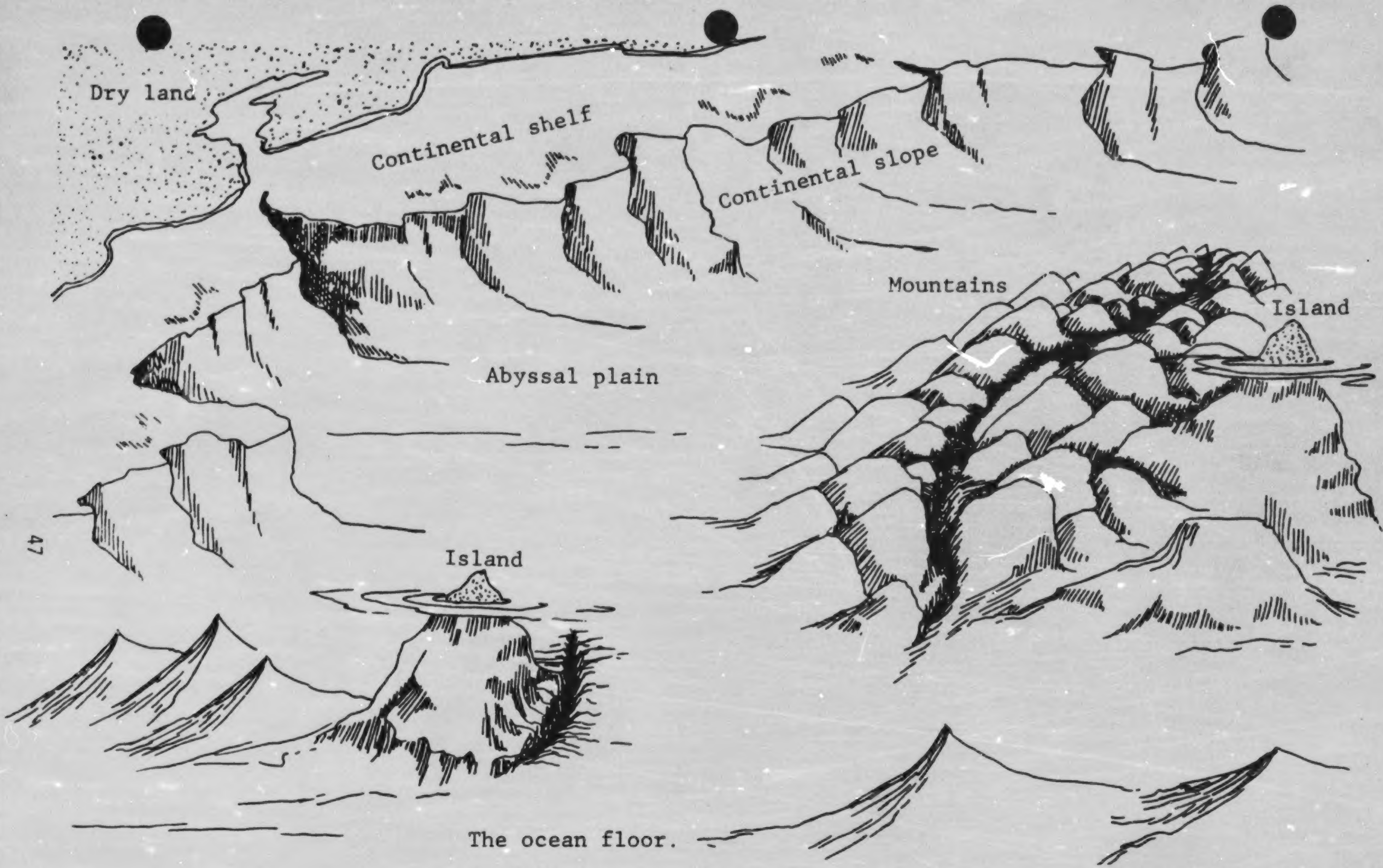
1. Circle the ocean closest to where you live.
2. Make an X by the ocean nearest the North Pole.
3. Are there really two Pacific Oceans? ________________
4. What is the real shape of the world? ________________________________
5. Color your map.

ocean surface



The waves go marching one by one.

1. Color the breaker green.
2. Color the other waves blue.
3. Draw a fishing boat on the waves.

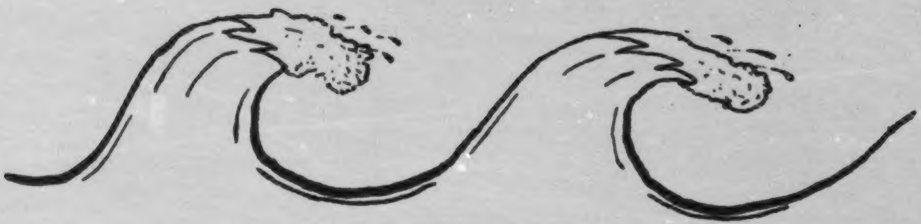

Dry land
Continental shelf
Continental slope
Mountains
Island
Abyssal plain
Island

The ocean floor.

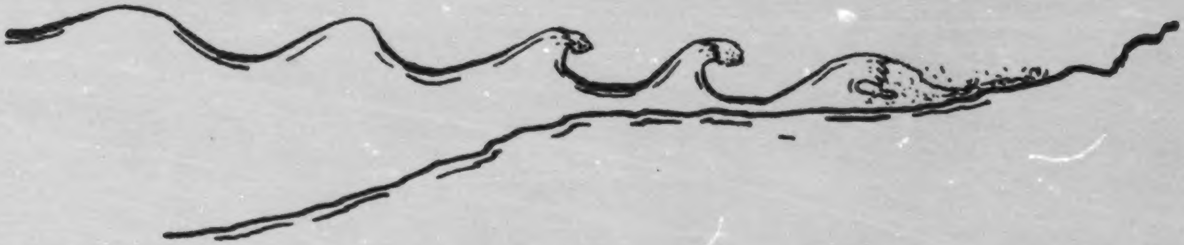
1. Color the dry land and the islands green.
2. The abyssal plain is the bottom of the ocean. Color it dark brown.
3. Color the mountains brown.
4. Color the rest of your picture.

*From Oregon State University Marine Science Education Tips.

overhead



White caps

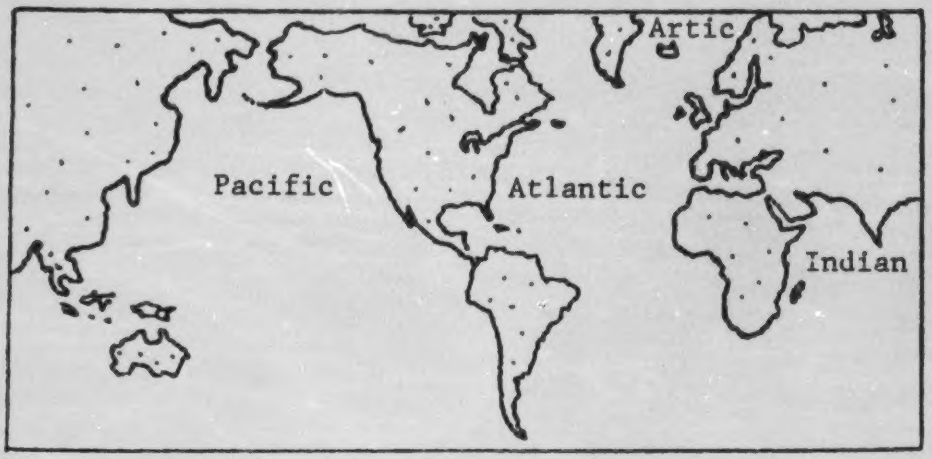


Breakers

Name____________________________

OCEANS

There is more water than land in the world. The largest bodies of water are called oceans. The names of the oceans are: Artic, Atlantic, Pacific, and Indian.



Map of the Oceans

1. What is the name of the ocean closest to where you live?

____

____

Ocean waters are salty. We use the same kind of salt on our food.

The oceans sometimes change colors. They may be shades of blue and green. Sometimes the green color comes from tiny creatures that live in the water. Clouds in the sky can also change the color of the ocean.

2. The color of the ocean may come from________________________

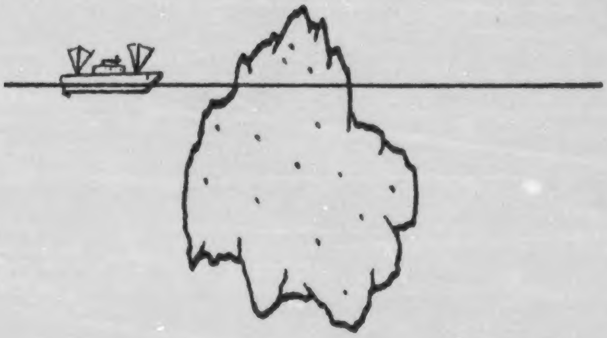
____.

Name ______________________________ Page 2

Most parts of the ocean are deep. In some places the oceans are deeper than a mountain is high.

In some places, the oceans are warm. Fish with beautiful colors live there.

In some places the oceans are cold. Large pieces of ice called icebergs float there.



An Iceberg

3. What would you find floating in the coldest oceans?

____

____

58

TEACHER BACKGROUND - Salt Water

"Salt Water" is an experiment in which your students will have the opportunity to see some of the properties of sea water. Stress careful observation and careful procedure for best results. The experiment provides an opportunity to observe apparent changes in matter as the salt dissolves in the water and is later recrystalized.

Duplicate the experiment pages. One set per student is recommended. Students may work alone, but pairs or small groups are preferred. Use caution when you use a lamp for a heat source in the presence of salt water. You may substitute a heater radiator or other heat source if it is more convenient than an electric light. Plan to take a few minutes to discuss the answers and the basic concepts covered upon completion of the activity. "More one step further......." may be duplicated and sent home as "homework" or you may elect to do it as a class activity. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

3. The salt dissapears (dissolves).

4. Yes, you can taste the salt at the top, in the middle, and on the bottom.

5. a. No, in the unmarked glass you cannot taste salt at the top, in the middle or on the bottom. This glass serves as a control. The salty taste might have come from the glass or from the water, without a control for comparison we could not tell for sure.

   b. The water will probably look the same, although some salt has aluminum silicate added to keep it from caking which will make the salt water slightly cloudy.

   c. The water in the glasses does not taste the same.

   d. The salt makes the difference (everything else was the same).

One Step Further......

4. There are white spots where the water drops were located.

5. No. The five drops near the "S" will have left a white residue while the other five will have left watermarks or nothing.

6. The spot will taste salty.

7. The salt makes the two types of spots different.

KEY WORDS

crystals

dissolve

evaporate
experiment
masking tape
materials
procedure
salt
stir
taste
teaspoon

60

Name______________________________ Page 1

SALT WATER

The oceans are full of salt water. Can we make salt water?

For this experiment you will need:

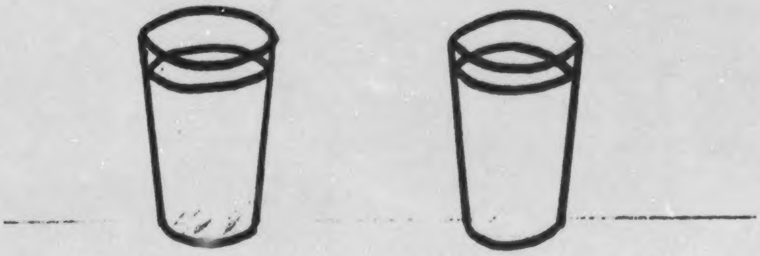
Materials:

- two drinking glasses
- teaspoon
- table salt
- two straws
- clean pie plate
- light
- tap water
- masking tape

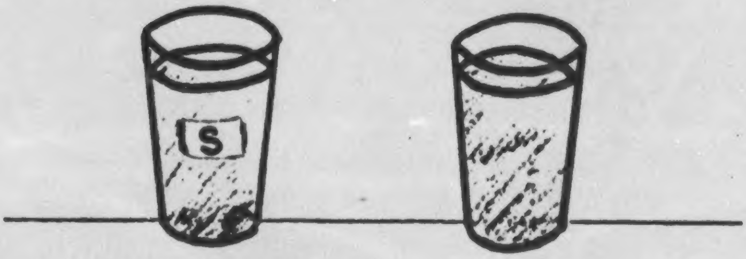
Here is what to do:

Procedure:

1. Nearly fill the two glasses with tap water. Put the same amount in each glass.

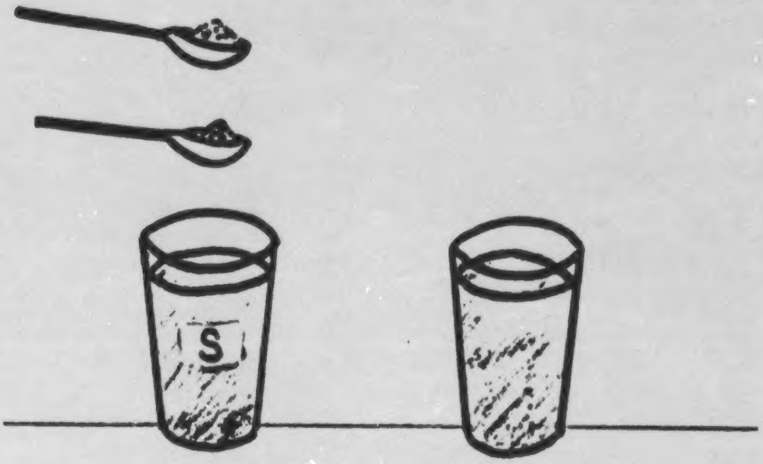


2. Write an "S" on one glass. Use a piece of masking tape.



Name________________________________ Page 2

3. Add two teaspoonfuls of salt to the glass with the "S". Stir it.



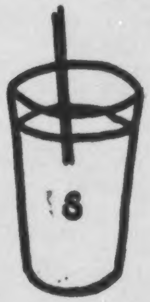
What happens to the salt?

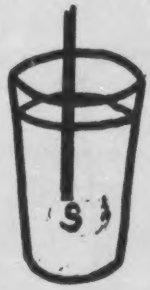
____

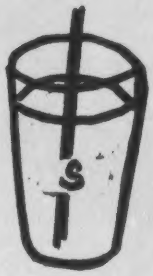
____

4. Taste the water in the glass with the "S". Use the straw. Taste it

at the top, in the middle, on the bottom.







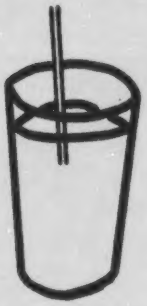
Can you taste salt at

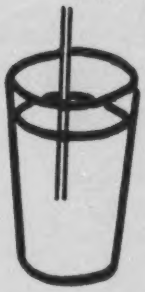
the top__________ in the middle____________ on the bottom?____

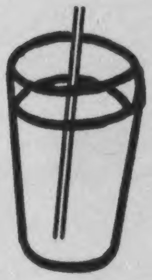
__________ ____________ ____________

Name____________________________

5. Taste the water in the unmarked glass. Use the straw. Taste it at the top, in the middle, on the bottom?







a. Can you taste salt at

the top__________ in the middle__________ on the bottom?____

__________ __________ __________

b. Does the water in the two glasses look the same?__________

____

c. Does the water in the two glasses taste the same?__________

____

d. What makes them different?__________________________________

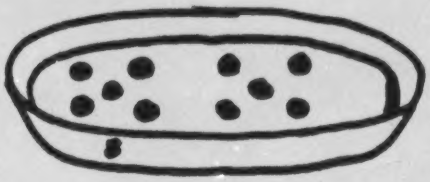
____

Name______________________________

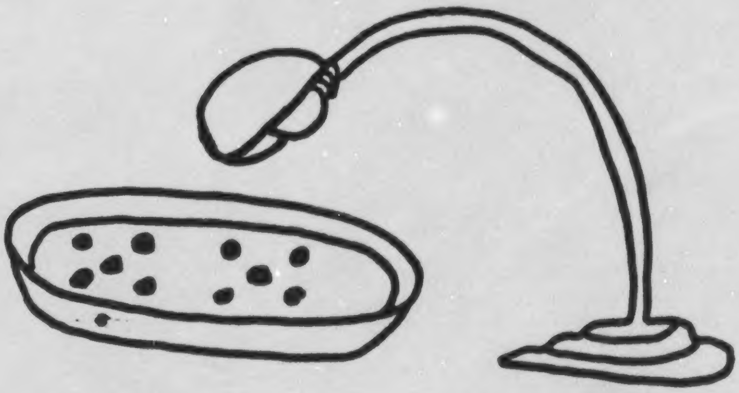
ONE STEP FURTHER......

We say the salt has dissolved in the water. Can we see the salt again? Try this:

1. Use your straw. Put five drops of water from glass "S" on a clean pie plate. Write an "S" near these drops. Use a piece of masking tape.
2. Put five drops of water from the unmarked glass on the pie plate.



3. Set the plate under a light. The light is warm.



4. Let the water evaporate. What do you see where the drops of water were? ______________________________
____
5. Are all ten spots the same? ____________________
6. Lick your finger. Pick up one of the white spots where the water was. How does it taste? ____________________
____
7. What makes the spots different? ____________________
____

MORE ONE STEP FURTHER......

Salt is not the only thing that will dissolve in water. Have your parents help you with this experiment. Here is what you will need:

Materials:

water, 1/2 cup
sugar, 1 cup
tablespoon
wooden spoon
measuring cup
small saucepan
pencil
small jar
paper clip
piece of string

Here is what to do:

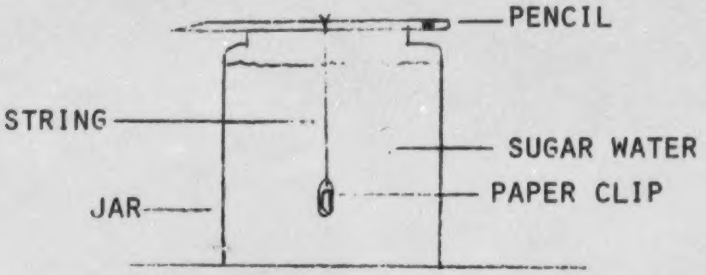
Procedure:

1. Put the water in the saucepan.
2. Put a tablespoonful of sugar in the water. Stir.
3. Heat the water over a low flame.
4. Stir in the rest of the sugar one tablespoonful at a time as the water heats.
5. Heat gently until all of the sugar is dissolved. Keep stirring!
6. Turn up the heat. Heat water to boiling. Boil for one minute while stirring. Remove from heat.
7. Pour the sugar water into the jar. Careful, it is very hot.
8. Tie one end of the string to the paper clip.

Name______________________________ Page 6

9. Tie the other end of the string to the pencil.

10. Lay the pencil on top of the jar. Hang the string and paper clip in the solution.



11. Put the jar in a cool spot.

12. Do not touch or move the jar for several days. If you let the crystals grow for a long period (over a week) you will get large pieces of rock candy.

13. Remove the candy and observe the crystal shape.

14. Can you do the same thing with salt?
Why not try?

66

TEACHER BACKGROUND - Icebergs

"Icebergs" continues the discussion of phases of matter and properties of water. Ice is something we take for granted, yet ice is one of the most unique sloids known. With the exception of water, as liquids cool and solidify they become more dense. If ice was more dense than water, it would sink. Big deal? The fact that the ice cubes would be at the bottom of a tall cool drink would be the least of our problems. If ice sank, ponds and lakes which freeze would freeze solid from bottom to top. The polar ice caps would be solid to the ocean floor. The climate would be altered by these more or less permanent ice bodies. The fact that ice floats is very significant indeed!

Duplicate the experiment pages. One set per student is recommended. Students may work alone, but pairs or small groups is preferred. Caution the students to brace themselves with their hands when they stand on the ice cube. You may substitute a mallet for ice breaking if you prefer. Allow a few minutes. Discuss the answers upon completion of the activity. The basic concepts covered also need to be discussed by the teacher. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

2. a. Yes, the ice cube floats.

   b. More ice is below the water than above the water.

   c. Most of the ice in an iceberg is below the water. Considering the visible top of icebergs may be as high as a ten story building, icebergs may be huge.

5. a. The cracked ice melts first.

   b. The cracked ice touches more water. The increased surface area in contact with the water speeds the melting.

   c. You could make an iceberg melt faster by breaking it into smaller pieces. This is actually done with explosives by iceberg patrols. Other answers are possible (heating, etc) but do not follow from the previous discussion. These other answers can, however, be a springboard to further discussion.

KEY WORDS

above

below

cube

float

iceberg

materials

melt
procedure
towel
warm
wrap

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Name ______________________________ Page 1

ICEBERGS

What can we learn about icebergs? Let's look at icebergs. Icebergs are hard to find. Maybe, we can use ice cubes. You will need these things:

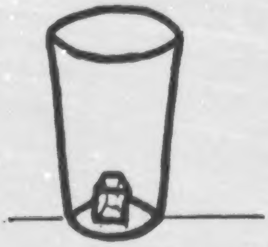
Materials:

two drinking glasses
tap water
warm tap water
ice cubes
paper towel

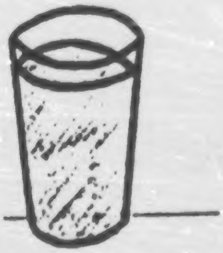
Here is what to do:

Procedure:

1. Put one ice cube in a glass.



2. Fill the glass with water



a. Does the ice cube float? ______________________________
____

Name ____________________ Page 2

b. Is more ice above the water or below the water? ____________

____

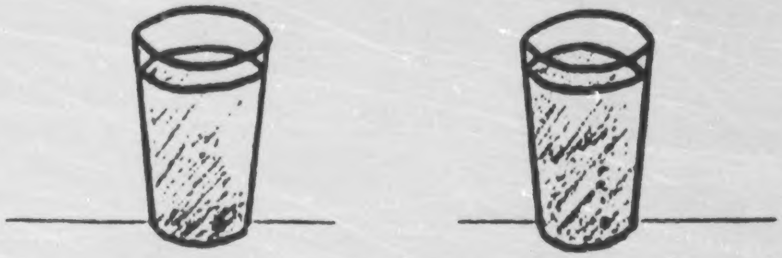
c. Icebergs are big ice cubes. In an iceberg, is more ice above or below the water? ______________________________

____

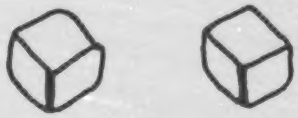
What else can we learn? Here is what you do:

Procedure:

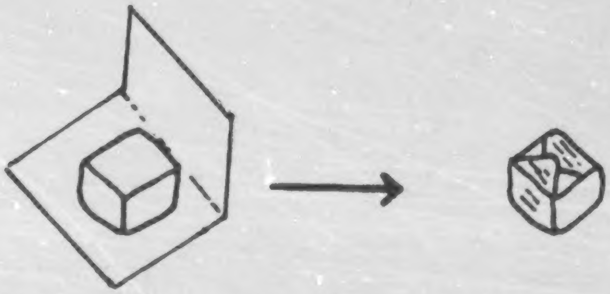
1. Fill the two glasses with warm water.



2. Get two ice cubes. Make sure they are the same size.

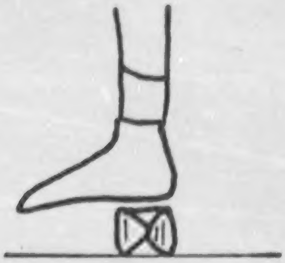


3. Wrap one of the ice cubes in paper.

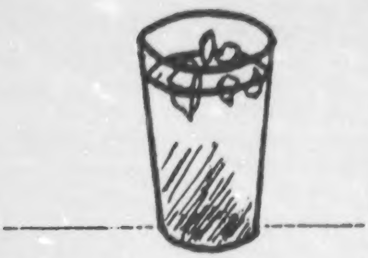


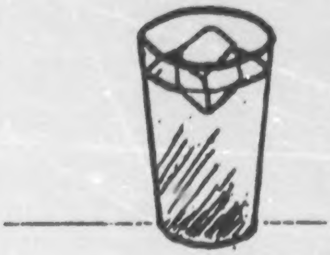
Name ____________________ Page 3

4. Stand on the paper to break the ice.



5. Put the pieces of ice in one glass. Put the ice cube in the other glass.





a. Which ice melts first? ____________________

____

b. Which ice touches more water? ____________________

____

c. How could you make an iceberg melt faster? ____________________

____

____

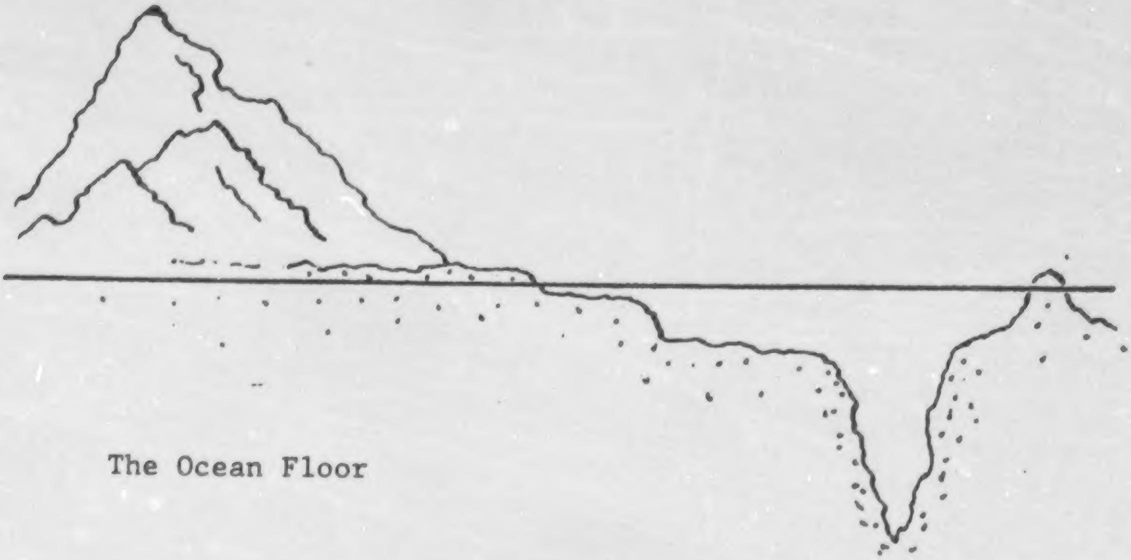
____

____

Name ______________________________

THE OCEAN FLOOR

The bottom of the ocean is called the floor. There are hills, mountains, and valleys on the floor of the ocean. There are rocks, shells, and fish, too.



The Ocean Floor

Sunlight does not reach the floor where the ocean is very deep. It is so dark that no plants can grow.

Some of the fish can make their own light. Parts of their bodies glow in the dark.

1. Can plants grow in the deepest part of the ocean? __________

____

TEACHER BACKGROUND - Deep In The Ocean

"Deep in the Ocean" introduces the idea of pressure. The great depths of the ocean combined with the substantial weight of water causes tremendous pressures on the bottom of the deep ocean. Pressures over one ton per square inch of surface area are not uncommon. These pressures make life on the ocean bottom difficult. In fact, until about 100 years ago, scientists thought that no life existed in the deepest parts of the ocean. The British Challenger expedition showed the fallacy of this theory. Animals that live in the great depths have evolved special adaptations to deal with the pressures and the darkness of their environment. Abyss is an interesting account of life in the deep ocean written by C.P. Idyll published by Thomas Y. Crowell Company, New York (1964).

Duplicate the experiment pages. One set per student is recommended. Students may work alone, but pairs or small groups is preferred. Since water will be flowing from the milk cartons, this experiment has the potential for being a bit messy. You can eliminate most of these concerns by doing the experiment in plastic wash trays or in a sink. Have a good supply of paper toweling on hand, none-the-less, plan to spend some time in discussion of the questions upon finishing the experiment. The basic concepts covered also need to be discussed by the teacher. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

3. a. Yes, the water falls out of all the holes.

   b. The water from the bottom hole should squirt out the (farthest).

   c. The water from the top hole should squirt out the least.

   d. The bottom hole has the most water above it.

   e. The things that would happen to you under the weight of a car would be, at the least, unpleasant. Animals that live under these pressures have equal pressures pushing outward within their body cells. The pressure from the cellular fluids equals the water pressure and the animals suffer no ill effects from the water column above them.

KEY WORDS

bottom
carton
centimeter
hole
materials
procedure
pressure

push
square inch
squirts
weight

DEEP IN THE OCEAN

What is it like on the ocean bottom? Let's see what we can learn. Here is what you will need:

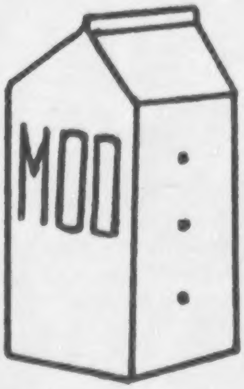
Materials:

empty milk carton (quart or 1/2 gal.)
pin
ball-point pen
water
ruler
sink or wash tray

Here is what you do:

Procedure:

1. Make three pin holes in the milk carton. Make one hole 5 centimeters from the bottom. Another hole 10 centimeters from the bottom. And the third hole 15 centimeters from the bottom. Make the holes above each other.



2. Make each hole larger with the ball point pen. Make the holes all the same size.

3. Put the carton in the sink. And fill it with water.

a. Does the water come out of all the holes? ________________

____

b. Which water squirts out the farthest? ________________

____

c. Which water squirts out least? ________________

____

Water squirts out because it is pushed. The water above pushes the water below.

d. Which hole has the most water above it? ________________

____

We say the bottom water has the most pressure. Pressure pushes down on the carton bottom. It also pushes down on things that live on the ocean bottom. In the deep ocean pressure is high. Fish have more than the weight of a car pushing on each square inch of their body.

e. What would happen to you under the weight of a car? ________

____

____

____

____

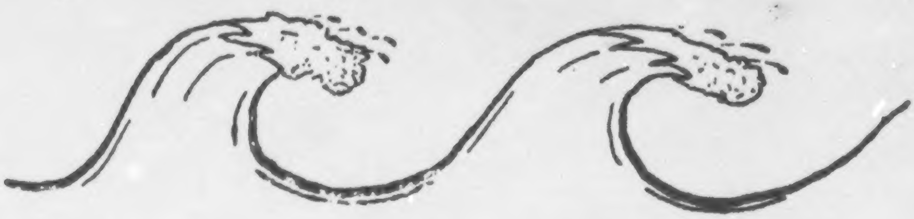
70

THE OCEAN SURFACE

The top of the ocean is called the surface. Many fish live near the surface of the ocean. Some of the smallest plants and animals in the world live near the surface waters. All sea animals find their food in the water around them.

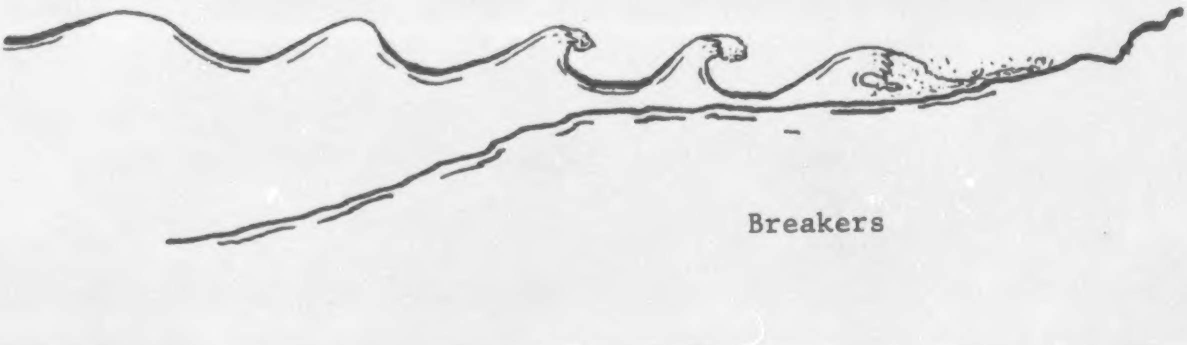
1. The top of the ocean is called the ______________________.

Wind blowing against the surface of the ocean makes waves. The white foam on top of a wave is called a white cap.



White Caps

When a wave rolls over itself, it is a breaker. Giant waves are sometimes taller than a ship.



Breakers

Name ______________________

They have great power. They can pound a ship to pieces against rocks in a storm.

2. What makes waves? ______________________

____

____

78

TEACHER BACKGROUND - Fast As The Wind

Wind is a primary force in wave production. The constant blowing of the winds over the surface of the oceans starts wave trains that may travel for thousands of miles before crashing on the beach. "Fast as the Wind" gives students an opportunity to measure wind speed and see the force present in the wind. The wind transfers energy to the water through friction. The energy is carried through the water in the form of waves. In spite of appearances, very little water is carried forward as the waves move along. The wave of energy actually passes through the water, rather than pushing the water ahead of it. Anyone who has been swimming in the surf can attest to the forces inherent in the ocean waves.

Duplicate the experiment pages. One set per student is recommended. Each student may make a wind speed guage, or you may have them work in pairs or in small groups. You may wish to go through the directions as a demonstration in front of the class before the class begins on their own. Encourage students to measure the wind speed in different locations. Plan to spend some time discussing their results and the effect of wind on the oceans. The "Key Words" should be taught if they are unfamiliar to your students.

KEY WORDS

blowing
facing
materials
measure
meter
miles per hour
pointer
procedure
scissors
speed
waves
wind

KEY WORDS

afraid
anemone
bivalves
borrow
chiton
clams
crabs
hermit
limpets
moon snail
oysters
plates
rays
sea star
shell
sideways
snail
starfish
tentacles
tube feet

Name ______________________

FAST AS THE WIND

Wind makes waves on the ocean. Fast wind makes big waves. The biggest wave ever measured was 112 feet high. That's as high as a ten story building! Can you measure the wind's speed? You can by getting these things:

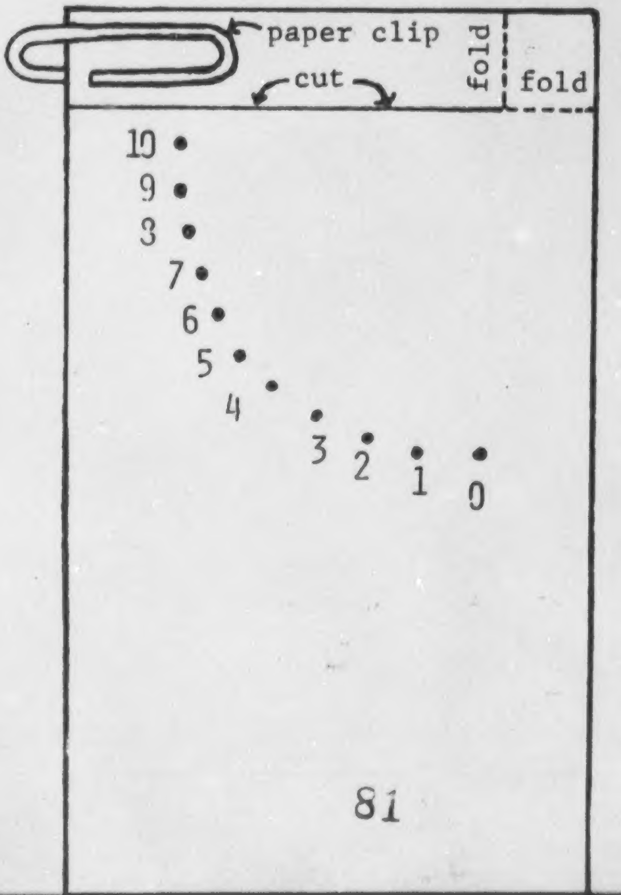
Materials:

3" x 5" card (an old post card will work)
pencil
paper clip
scissors

Here is what to do:

Procedure:

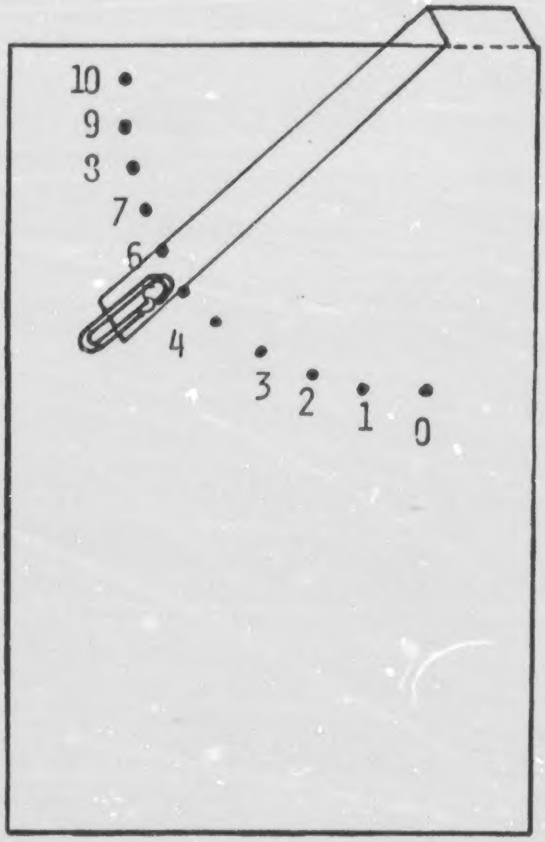
1. Use the picture below. Copy the lines and numbers on your card.



2. Cut along the line that says "cut".
3. Fold along the two lines that say "fold".
4. Put a paper clip at the end of the cut piece.

You have made a wind speed meter. Here is how to use it:

1. Hold it up facing the wind. The paper clip pointer will move in the wind.
2. Read the number by the pointer. That's the speed of the wind.



If the number is 5, the wind is blowing at 5 miles per hour. The wind would push on the water at 5 miles per hour.

3. Use your meter to measure wind speed in different places.

TEACHER BACKGROUND - Underwater Scenes

"Underwater Scenes" is an exercise designed to arouse interest in the activities that are coming. It will also give you an informal assessment of your students' sea knowledge.

Duplicate the directions. One copy per student is recommended. It is possible to read the directions to your class rather than to hand them out. There is an advantage to having students learn to follow a written, sequential procedure. Your particular situation will dictate the procedure followed. The "Key Words" should be taught if they are unfamiliar to your students.

You may meet some resistance to the idea of smearing paint all over their creations. You might have a completed drawing to show them the results. Encourage them to be daring.

Display the creations on a classroom bulletin board. You might also allow a few minutes for show and tell about the paintings.

KEY WORDS

consistency

ocean surface

scene

strokes

underwater

waxy

Name ______________________________

UNDERWATER SCENES

What would it be like to live under the sea? You have read about the ocean surface. Soon you will learn about what lives under the surface. Use what you know about the ocean to draw a picture. Draw what it would be like to live under the ocean.

Materials:

manila or white drawing paper
crayons
waterbase paint or tempera mixed to a thin consistency (like water)
wide paintbrush.

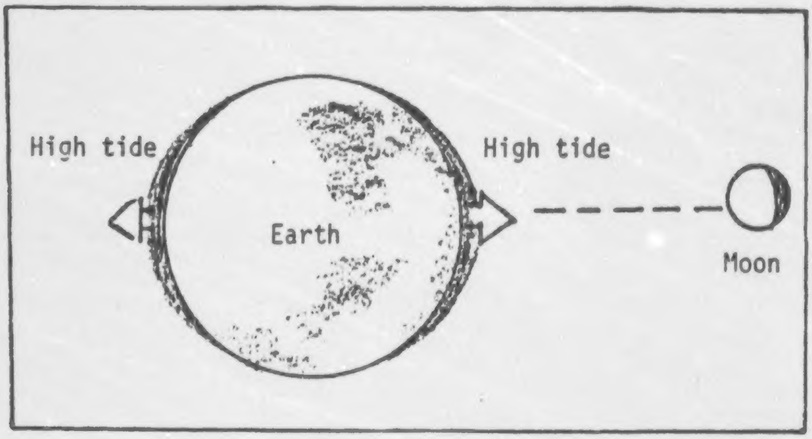
Procedure:

1. Draw your underwater scene with crayons on the drawing paper. Press heavily. All crayon areas must be very waxy.
2. Use the paintbrush. Make quick, smooth strokes to wash paint across your picture. You picture will not disappear. Honest!
3. Let your picture dry.
4. Display your picture.

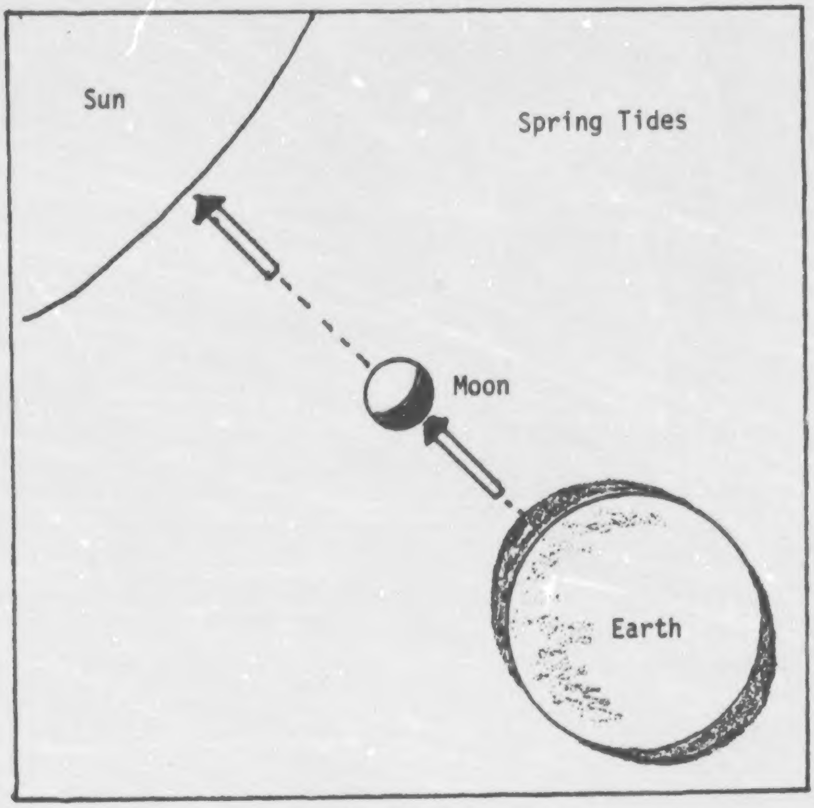
TEACHER BACKGROUND - Tides

Tides are an intergral part of knowledge of the sea. Yet, tides are often a difficult concept to grasp. "Tides" is an introduction to the idea of tidal movement and tidal differences. Any good oceanography text can supply you with material to understand the causes of the tides. If you desire to involve the class at a deeper level you might read them The Rise and Fall of the Sea by Ruth Brindze (1964). Harcourt, Brace and Word, Inc. New York. 96 pages.

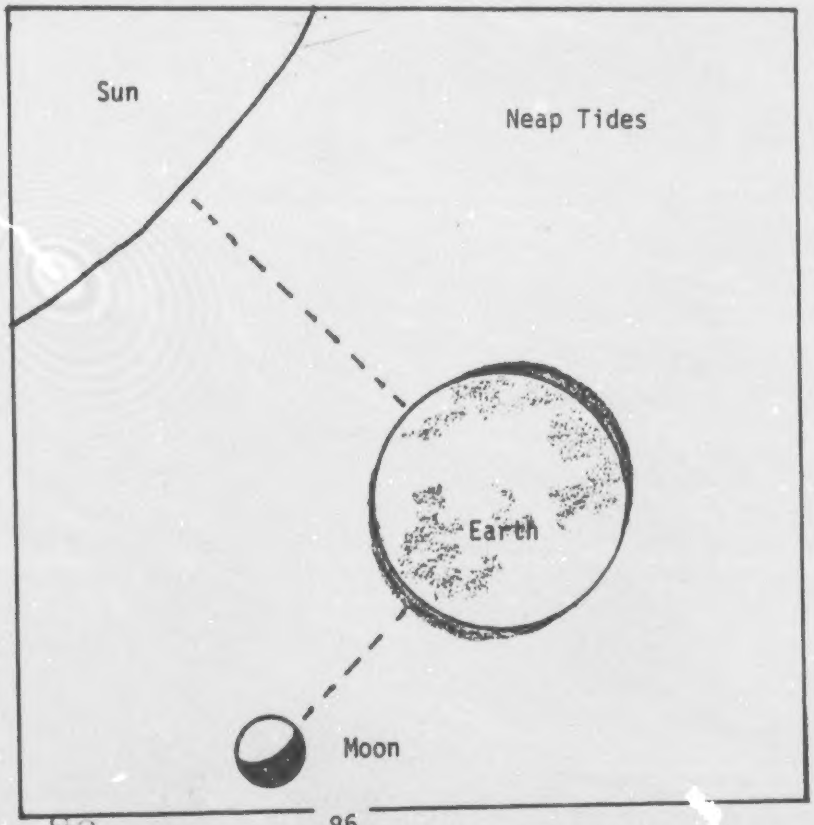
The tides we see are a result of gravity. The moon and the sun exert attractions on the waters of the earth. Even though the moon is much smaller, the moon, because it is so close to the earth, exerts the major pulling force on the water causing a great bulge in the ocean directly under it. This tidal bulge tends to follow the moon as it orbits around the earth. The centrifugal force from the earth's rotation creates a second bulge in the ocean on the opposite side of the world.



The effect of the sun is to increase or decrease the size of the bulge created by the moon. Once every 28 days the sun and the moon are in line with each other. At this time, the combined pulling forces of both the sun and the moon on the earth produce the highest rise in water levels along our coasts. These tides are called spring tides. Spring tides occur all year long. The term "spring" comes not from the season but rather from the "springiness" of the water movement.


Sun
Spring Tides
Moon
Earth

Twice every 28 days the moon is at right angles to the sun. The attraction of the moon for the earth cancels out the sun's attraction for the earth. At these times, there is the smallest rise in water levels. We call these tides "neap tides".


Sun
Neap Tides
Earth
Moon

Tidal rises and falls occur twice each twenty four hours and fifty minutes. The height and times of the tides are also influenced by the shape and location of the shoreline.

For further information you may want to see "Understanding the Tides" an Oregon State University Sea Grant publication SG 25 by R. Lawrence Swanson. The publication is available free from Oregon State University Extension, Corvallis, Oregon 97331.

Duplicate the text pages. One set is recommended per student. The basic concepts covered in the reading need be discussed by the teacher. The "Key Words"should be taught if they are unfamilar to the students

KEY - Text questions

1. The tide is the movement of the waters.
2. The pull of the sun and the moon on the earth cause the tides.
3. The two pictures are different in many ways. The differences are due to the difference in tidal heights. The top picture is high tide, the bottom picture is low tide.
4. We call the time when the tide is furthest up on the beach "high tide".

KEY WORDS

beach
edge
exposed
furthest
lowest
movement
sloping
tidal zone
tide

Name ______________________________

TIDES

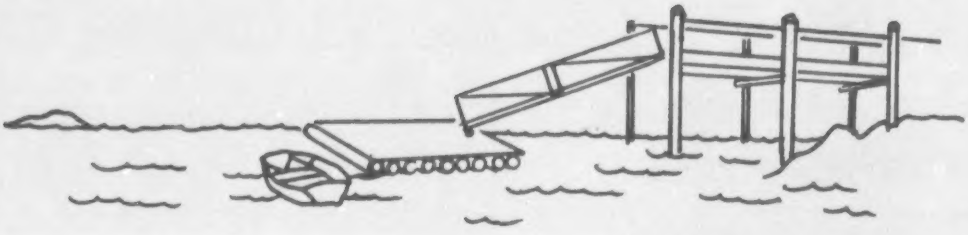
Twice everyday the waters of the ocean move far up sloping beaches. The water covers the animals and plants living at the ocean edge. Also, twice every day the water level goes down. The living things are exposed. This movement of the waters is called the tide.

1. The tide is the ______________________________ of the waters.

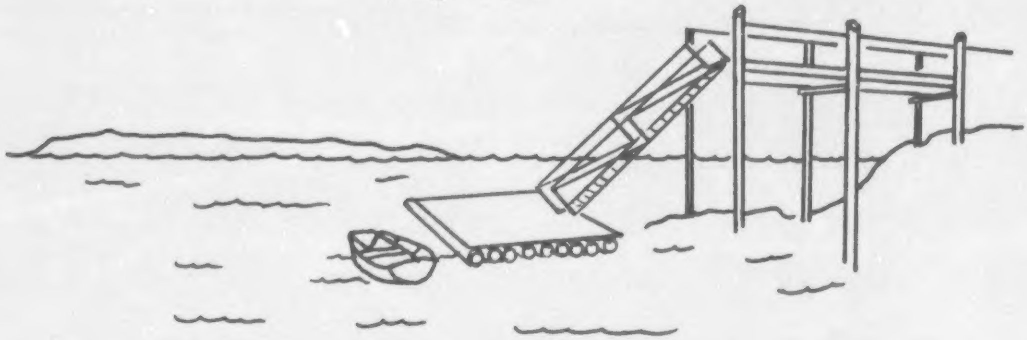
What causes the tides? The pull of the sun and the moon on the earth cause the tides. We call one tide "High". The other tide we call "Low". High tide occurs when the water is all the way up on the beach. Low tide occurs when the water is at its lowest point on the beach.

2. What causes the tides? ______________________________
____

Name ______________________ Page 2



High Tide



Low Tide

3. How are these two pictures different?

____

____

Animals living in the tidal zone are covered with water two times a day. They are also exposed to air two times a day.

4. What do we call the time when the tide is furthest up on the beach? ______________________________

____

TEACHER BACKGROUND - Tide Gage Indicator

The activity "Tide Gage Indicator" is designed to help the student understand that the tide comes in and goes out twice in a 24 hour period, and that tides vary daily in time and height. The Tide Gage Indicator and charts can be used to introduce or reinforce the mathematical concepts of graphing, coordinates, time, frequency and periodicity, and negative numbers. It is helpful to remind students that the tides are caused by the position of the sun and moon.

Duplicate the dock template. One template per student is recommended. It may not be necessary to reproduce a complete set of daily tide charts for each student. The Daily Tide Charts can be posted on the bulletin board end to end to show a continuous week's tides. It may be necessary to go over the "Procedure" section with the students. Tide heights are determined by overlaying the dock template on the desired Daily Tide Chart and aligning the clock cut-out over the desired time. The tidal height is seen in the third cut-out located next to the tide gage indicator on the piling. It is recommended that the teacher try this exercise before doing it with the class. Provide needed assistance with the cutting.

These Daily Tide Charts were constructed from an actual tide chart of Puget Sound for the week of January 7, 1974 to January 11, 1974. They are intended to represent an arbitrary week. Therefore, Monday's chart will not necessarily represent every Monday's tide changes. If a tide chart is available, new daily tide charts can easily be constructed to represent the time of actual tide changes during the unit of study.

Plan to devote some time to a discussion of the cativity and the basic text concepts covered. The "Key Words" should be taught if they are unfamiliar to your students.

KEY - questions

1. The height of the tide at noon on Monday is + 9 feet.
2. The height of the tide at noon on Tuesday is + 7 feet.
3. The highest tide on Thursday is about 9:00 in the morning. (This time is an estimate so answers may have some variation).
4. The lowest tide on Tuesday is at 12:00 midnight.
5. The tide comes in twice each day.
6. The tide goes out twice each day.

KEY WORDS

chart

dock

height
highest
lowest
tide
tide gage indicator
typical

Name ______________________________

TIDE GAGE INDICATOR

The tide comes in and goes out twice a day. The time of the tidal movement is not the same every day. The distance the tide moves in and out also changes.

This activity will give you a chance to see how tides change. The daily tide charts you will use are for a typical week. Monday's chart will not be the same for every Monday's tide changes.

Materials:

dock drawing
scissors

Procedure:

1. Fold your dock drawing in half on the dashed (-----) line.
2. Cut out the three slash marked (/////) sections on the dock drawing.
3. Cut the paper in two along the dotted (......) line.
   To find the tide height lay the dock drawing on the correct Daily Tide Chart. Line up the clock cut-out over the correct time.

   Read the height of the tide on the tide gage indicator. The tide gage indicator is the bottom cut-out.
4. Answer the questions on "The Tide Gage".

Name ____________________ Page 1

THE TIDE GAGE

1. What will be the height of the tide at noon on Monday? ______

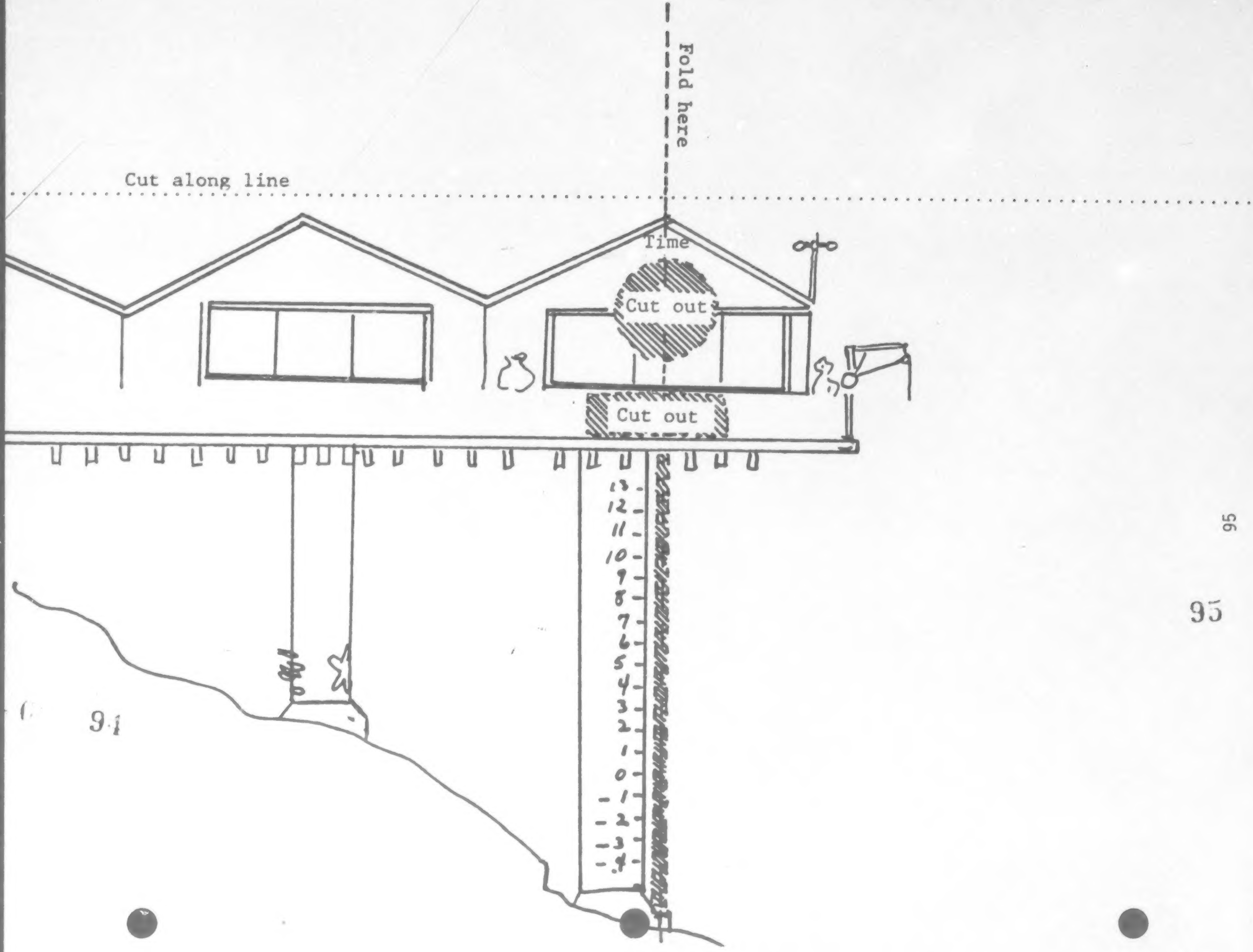
2. What will be the height of the tide at noon on Tuesday? ______

3. What time is the highest tide on Thursday? ______

4. What time is the lowest tide on Tuesday? ______

5. How many times does the tide come in each day? ______

6. How many times does the tide go out each day? ______

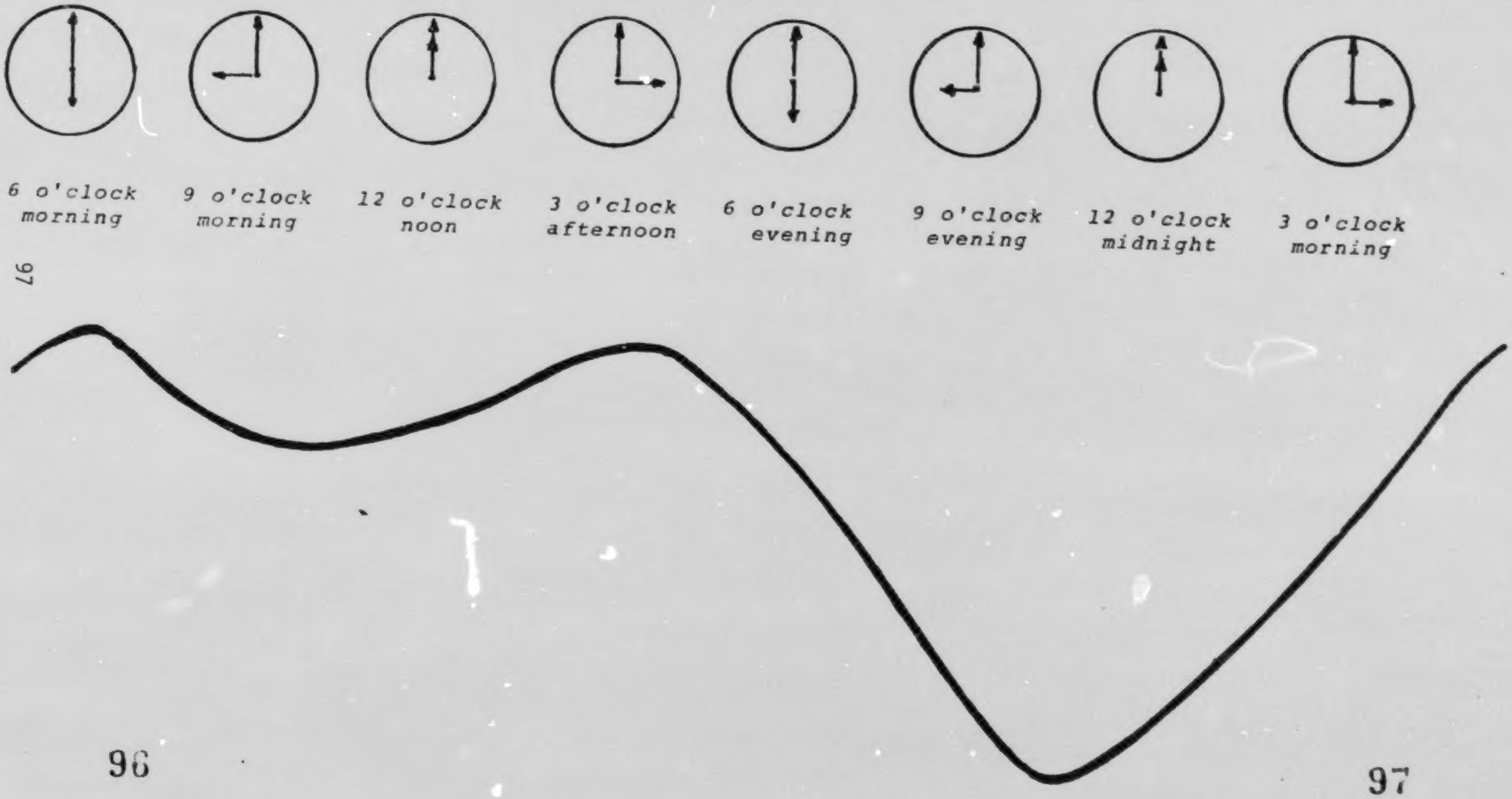


Fold here

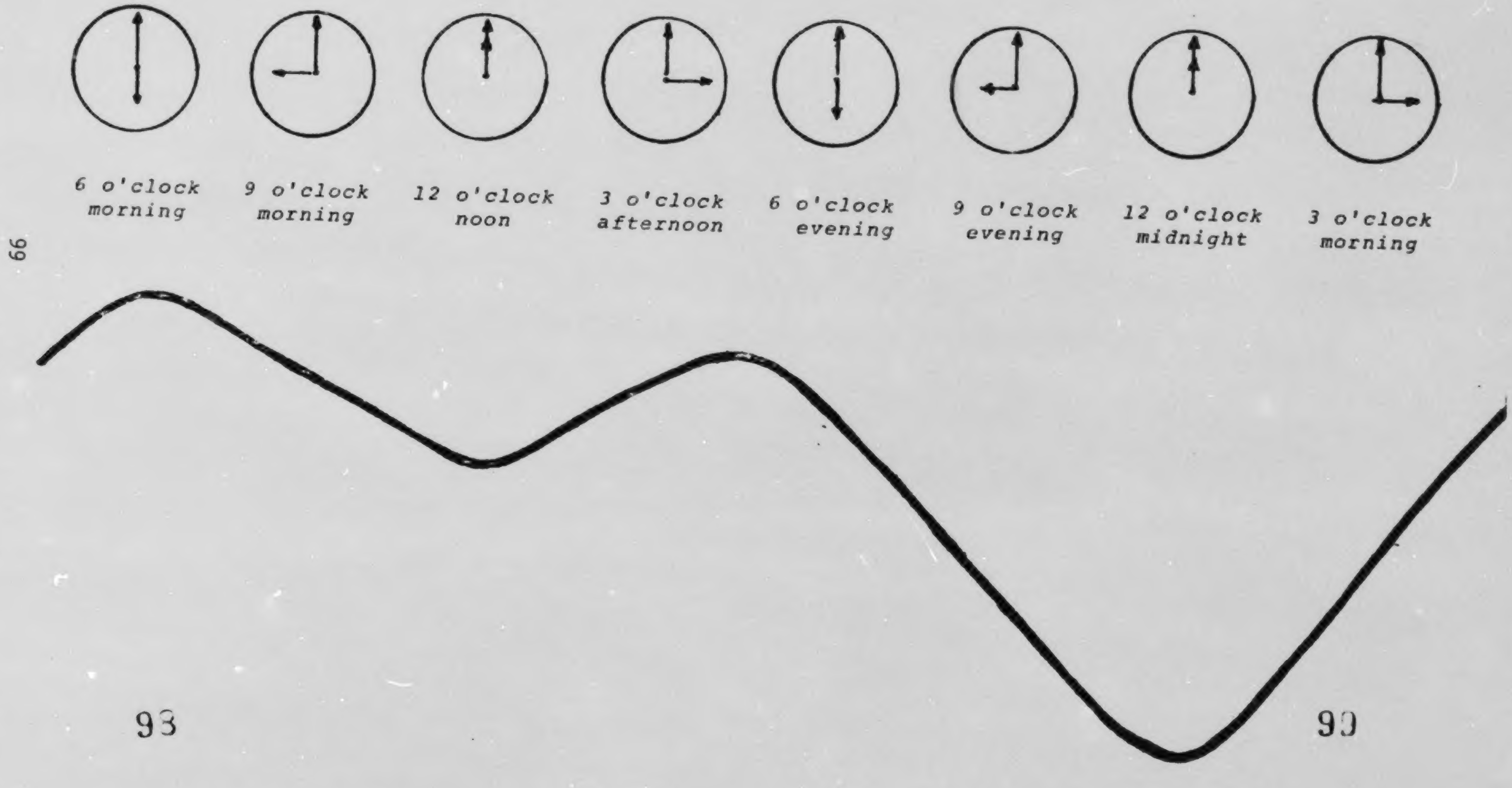
Cut along line

Time
Cut out
Cut out
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4

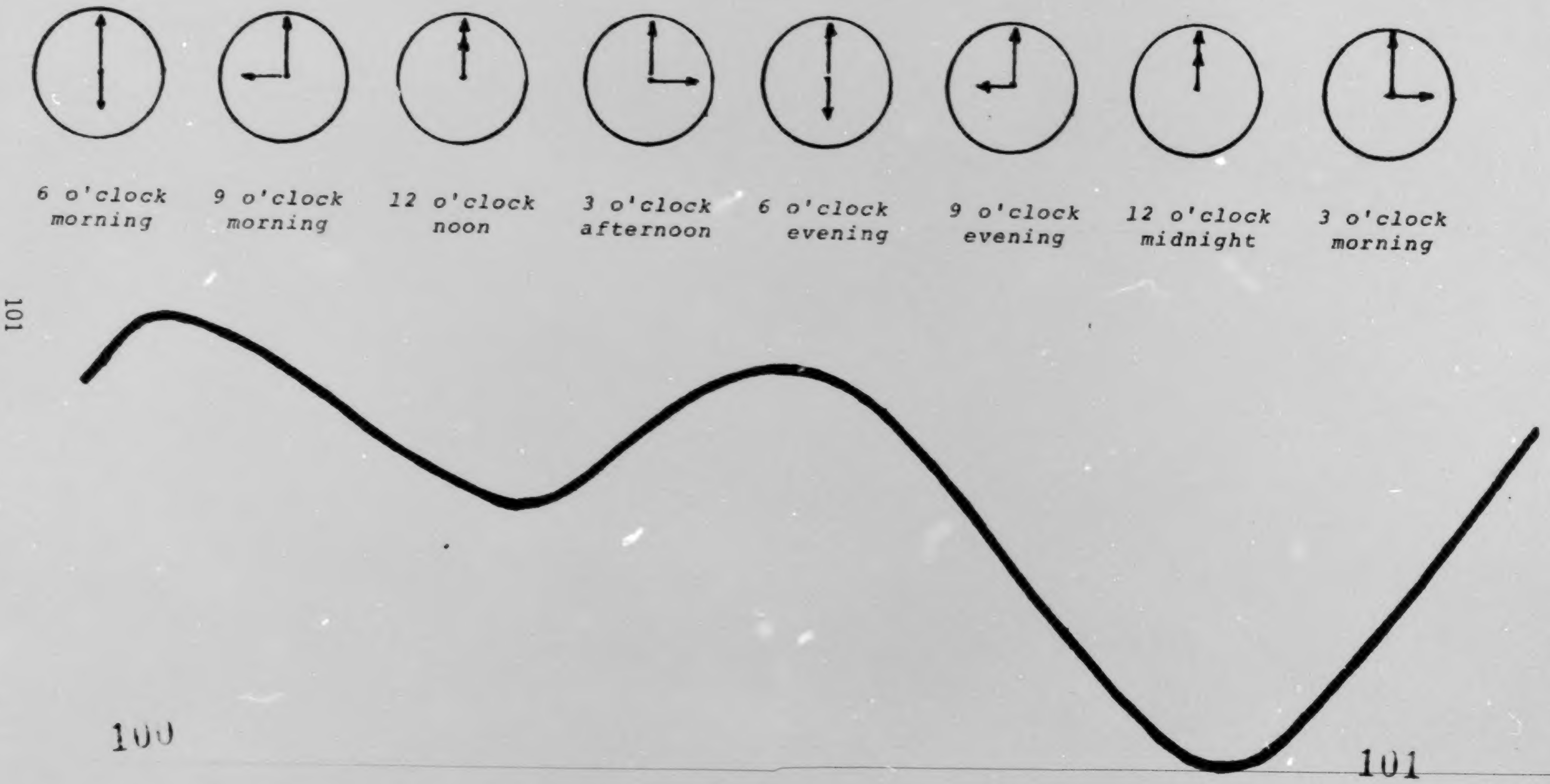
MONDAY


6 o'clock morning
9 o'clock morning
12 o'clock noon
3 o'clock afternoon
6 o'clock evening
9 o'clock evening
12 o'clock midnight
3 o'clock morning
97

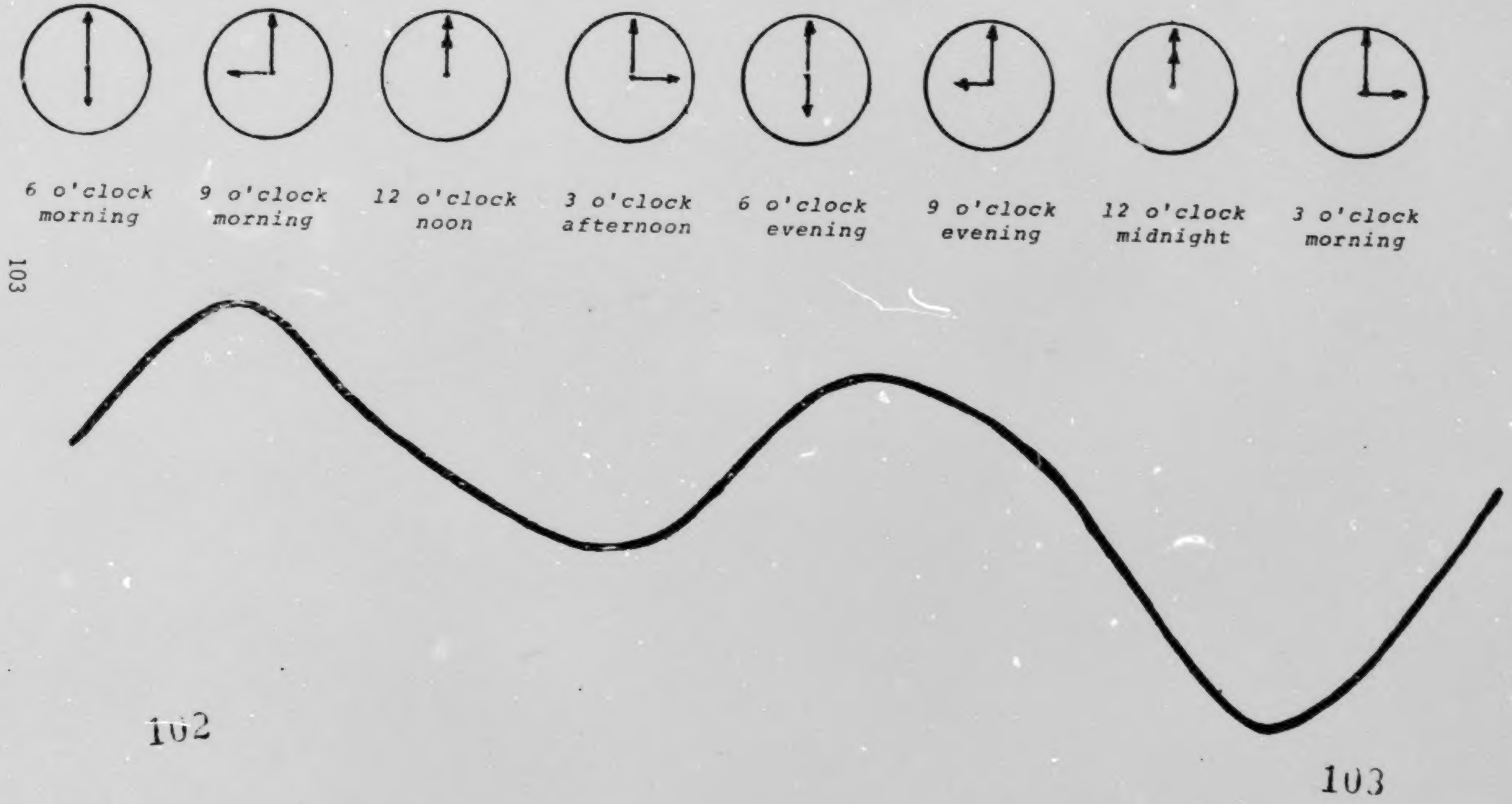
TUESDAY


6 o'clock morning
9 o'clock morning
12 o'clock noon
3 o'clock afternoon
6 o'clock evening
9 o'clock evening
12 o'clock midnight
3 o'clock morning
99
98
90

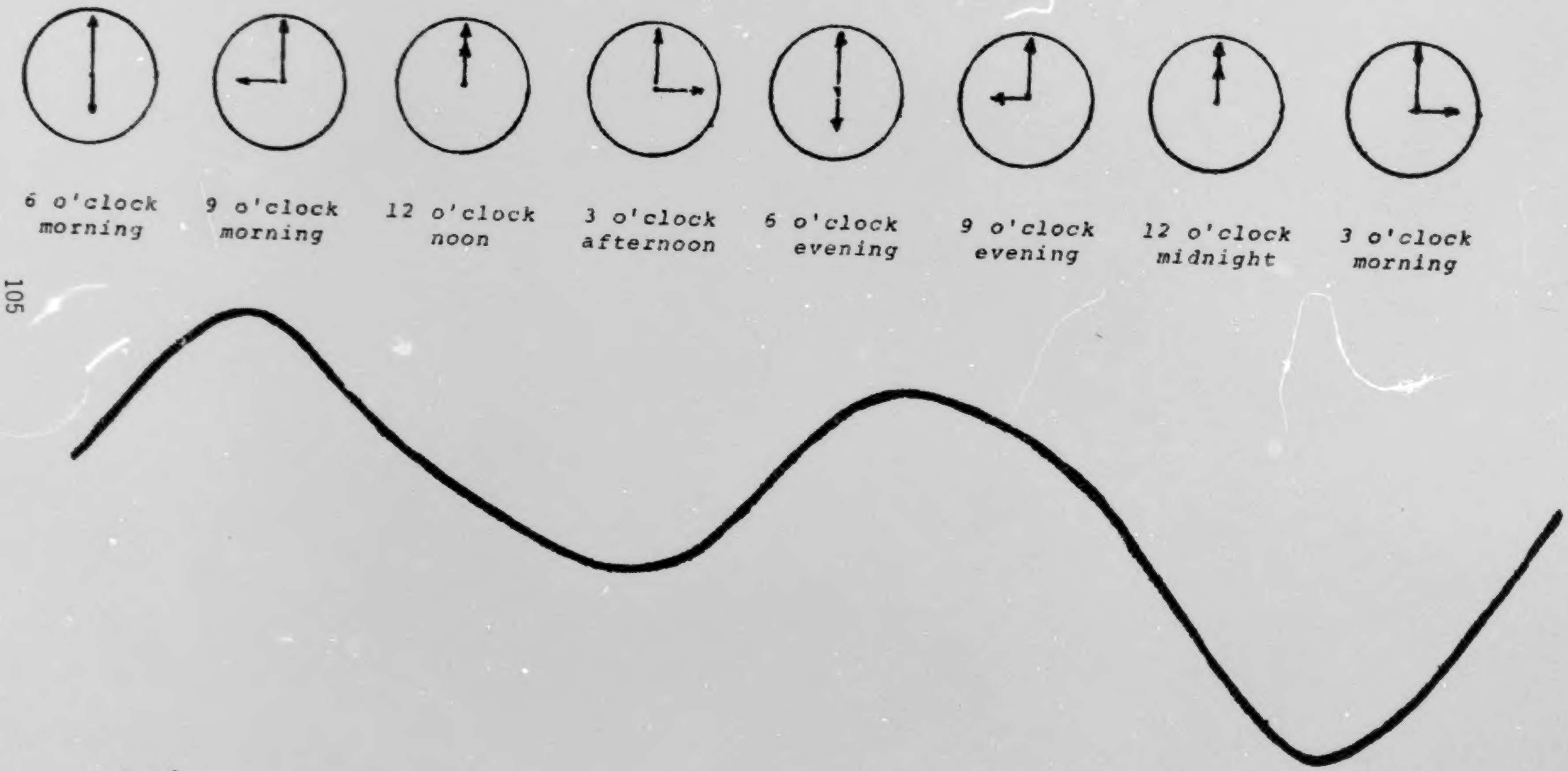
WEDNESDAY


6 o'clock morning
9 o'clock morning
12 o'clock noon
3 o'clock afternoon
6 o'clock evening
9 o'clock evening
12 o'clock midnight
3 o'clock morning
101
100
101

THURSDAY


6 o'clock morning
9 o'clock morning
12 o'clock noon
3 o'clock afternoon
6 o'clock evening
9 o'clock evening
12 o'clock midnight
3 o'clock morning
103
102
103

FRIDAY


6 o'clock morning
9 o'clock morning
12 o'clock noon
3 o'clock afternoon
6 o'clock evening
9 o'clock evening
12 o'clock midnight
3 o'clock morning

FISH

TEACHER BACKGROUND - Fish

This section is designed to relate biolobical structure with biological function. As you teach, emphasize the relationship between structure and function.

The structure of the caudal or tail fin is ideally suited for propulsion and steering. The dorsal, anal and adipose fins are used for roll stability, some steering and limited protection. Pectoral and pelvic fins are used for vertical, horizontal movement and steering functions. Gills are specialized structures for gas exchange somewhat analogous to lungs. (Absorption of oxygen and expulsion of carbon dioxide). See "Plants and Animals Depend on Each Other."

Protection may come from camouflage, speed, maneuverability, or specialized structures for schooling. Most flat fish and bottom fish (flounders, rays, sculpins) use camouflage, while fish like the salmon, herring and smelt rely on maneuverability, speed and schooling. Nearly all fish rely on specialized structures like teeth or spines.

This unit is designed to justify conservation efforts and to develop proper attitudes for wise use of sport and commercial fishing. A visit to a fish hatchery could be beneficial in reinforcing this concept and the related concepts of reproduction, life cycle and food chains. An excellent book on fish schooling is entitled Swimmy by Leo Lionni.

The teacher may be surprised at the number of students that have never had the experience of going fishing.

Make use of aquaria and fresh or frozen fish to show your students what fish really do look like. Pictures can be used to show the incredible variety that exists in form and shape among the fishes.

Coloring worksheets follow the "Teacher Key" section. They should be used after the text has been studied for reinforcement.

KEY - Text questions

1. This fish has eight fins (only seven show, the eighth is a pectoral fin on the opposite side. The answer to this question depends, in part, on the concept of bilaterial symmetry - the fish is made in two mirror image halves.
2. The dorsal fin is used to prevent rolling. The anal and adipose also have a role in preventing rolling.
3. The caudal or tail fin supplies the power necessary for fast swimming.
4. Schools seem to offer protection by having many eyes that can see possible danger as it approaches..they may also sense vibrations ("hear") more effectively in a school. In spite of all indications that schooling is an effective adaptation, no one has really been able to show why it is so effective. Other explanations, include that the school may look like a much larger fish and offer protection in this manner; the school shape may be a more efficient way to move through the water, or perhaps schooling facilitates reproduction. This is an area of current study. Speculation can lead to hypothesizing and experimentation which may finally give us some answers.

5. Gills are like lungs in that they take oxygen out of the surrounding environment.

6. Salmon are born in fresh water streams.

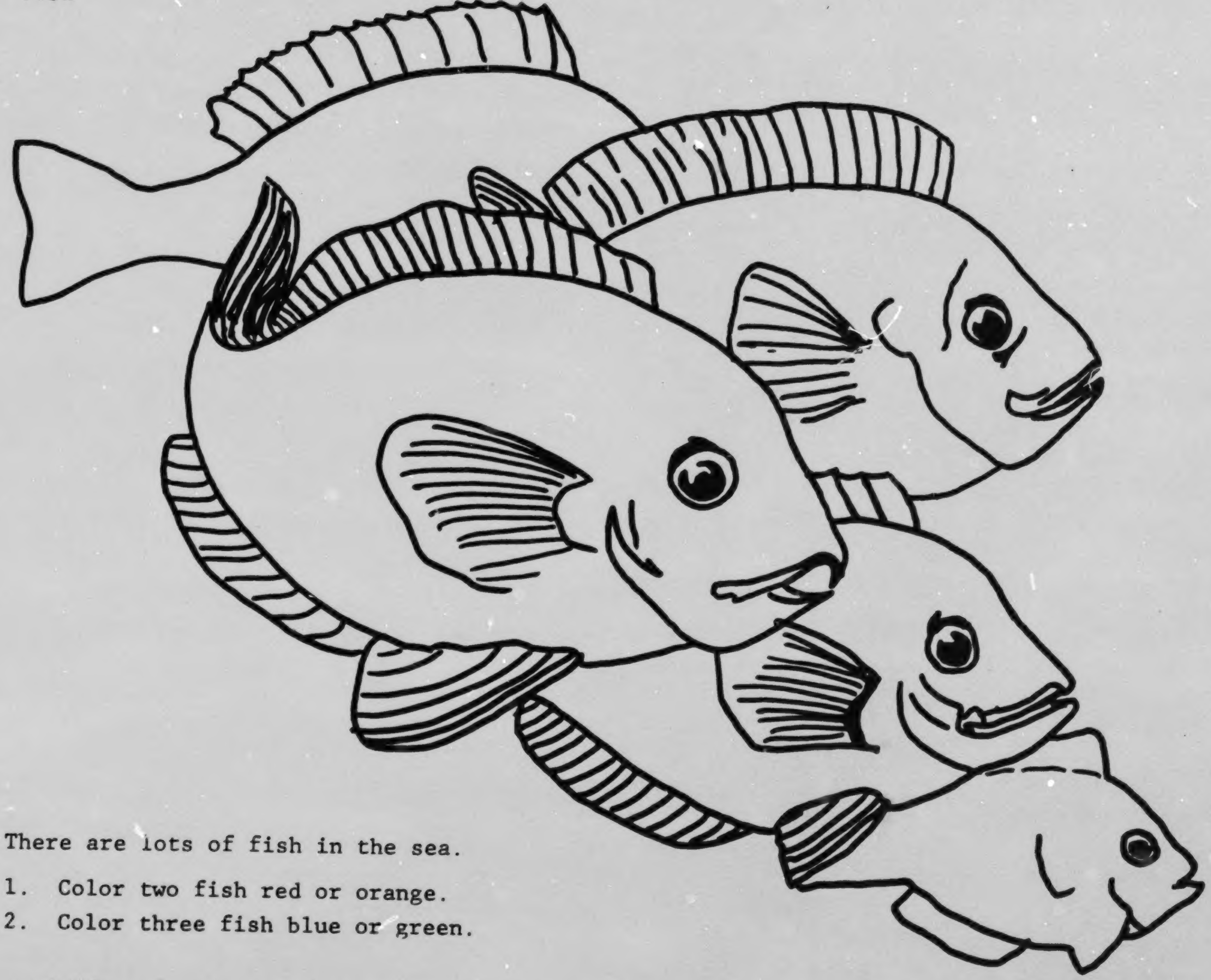
7. Sculpins or bullheads would be hurt since they often lay their eggs on the bottom side of rocks to help protect them.

8. If we overfish we may not leave enough fish to reproduce and replenish the fish population. This is a serious problem as nets and fishing gear become more efficient and costly.

KEY WORDS

adipose
anal
carbon dioxide
caudal
dorsal
function
gill
lung
overfish
oxygen
pectoral
pelvic
protection
schools
structure

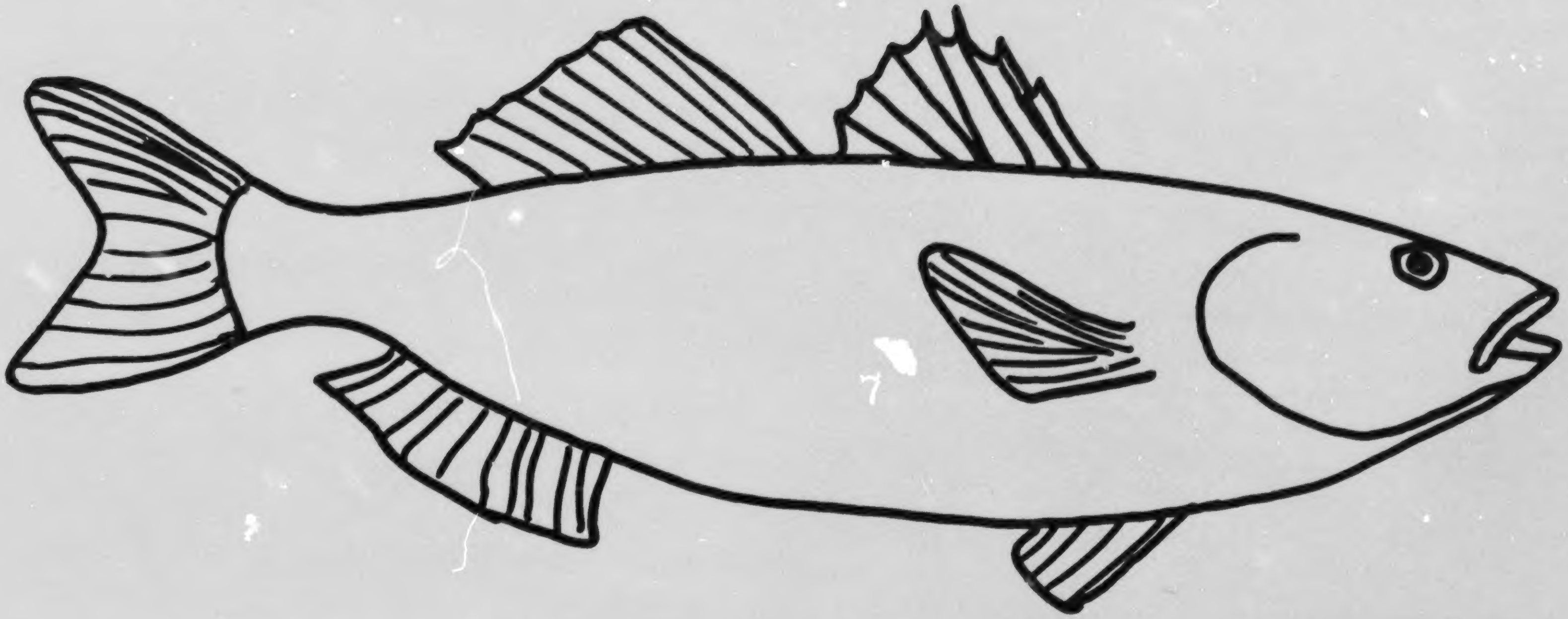
fish



There are lots of fish in the sea.

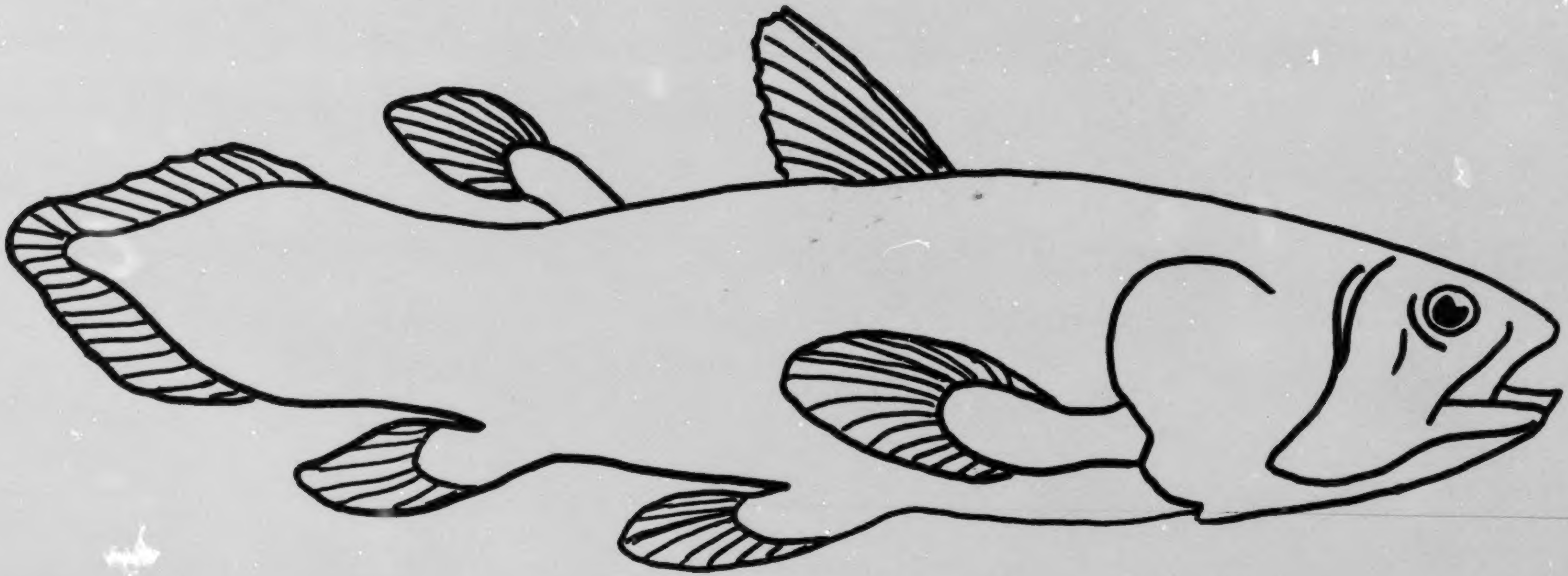
1. Color two fish red or orange.
2. Color three fish blue or green.

fish



A good swimmer.

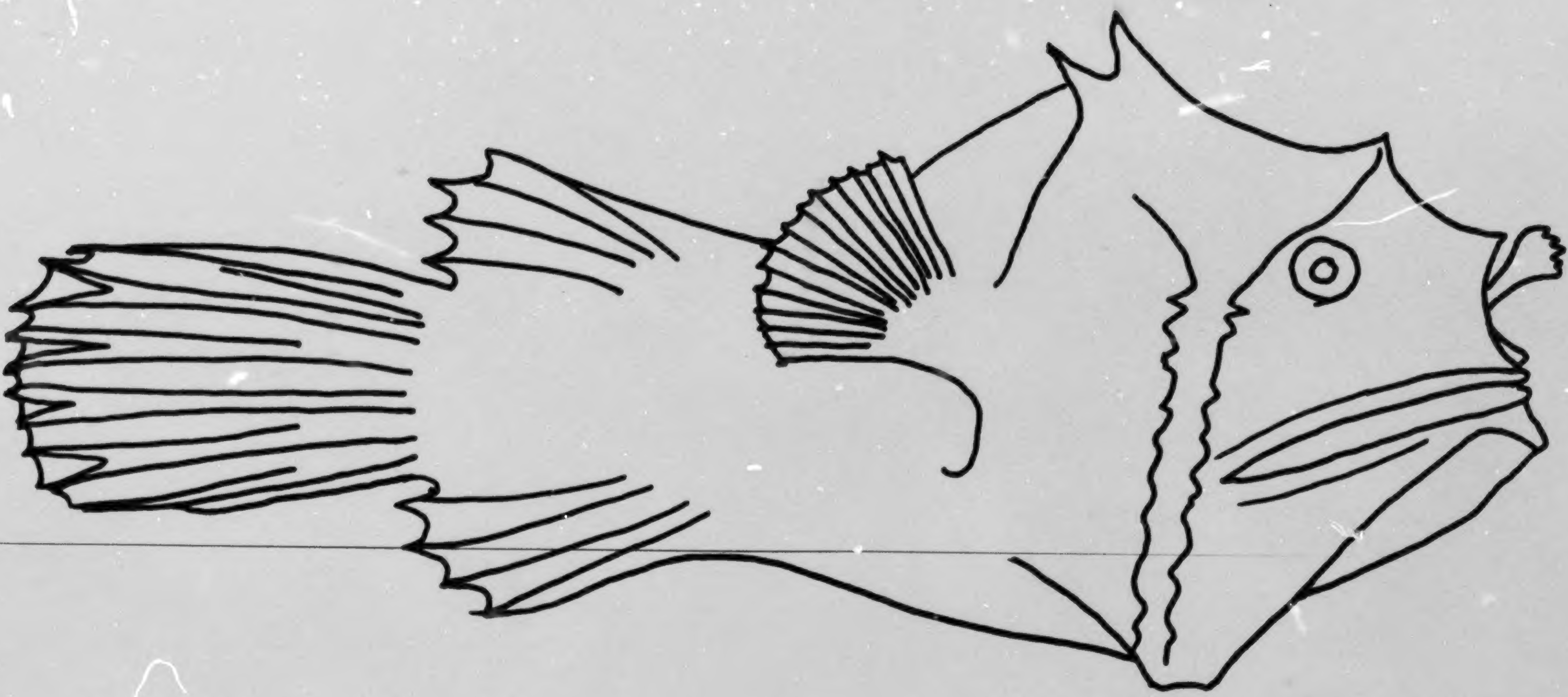
1. Put an X on the caudal fin.
2. Put a ☐ around the pectoral fin.
3. Put a ○ around the anal fin.
4. Color your fish.



A living fossil.

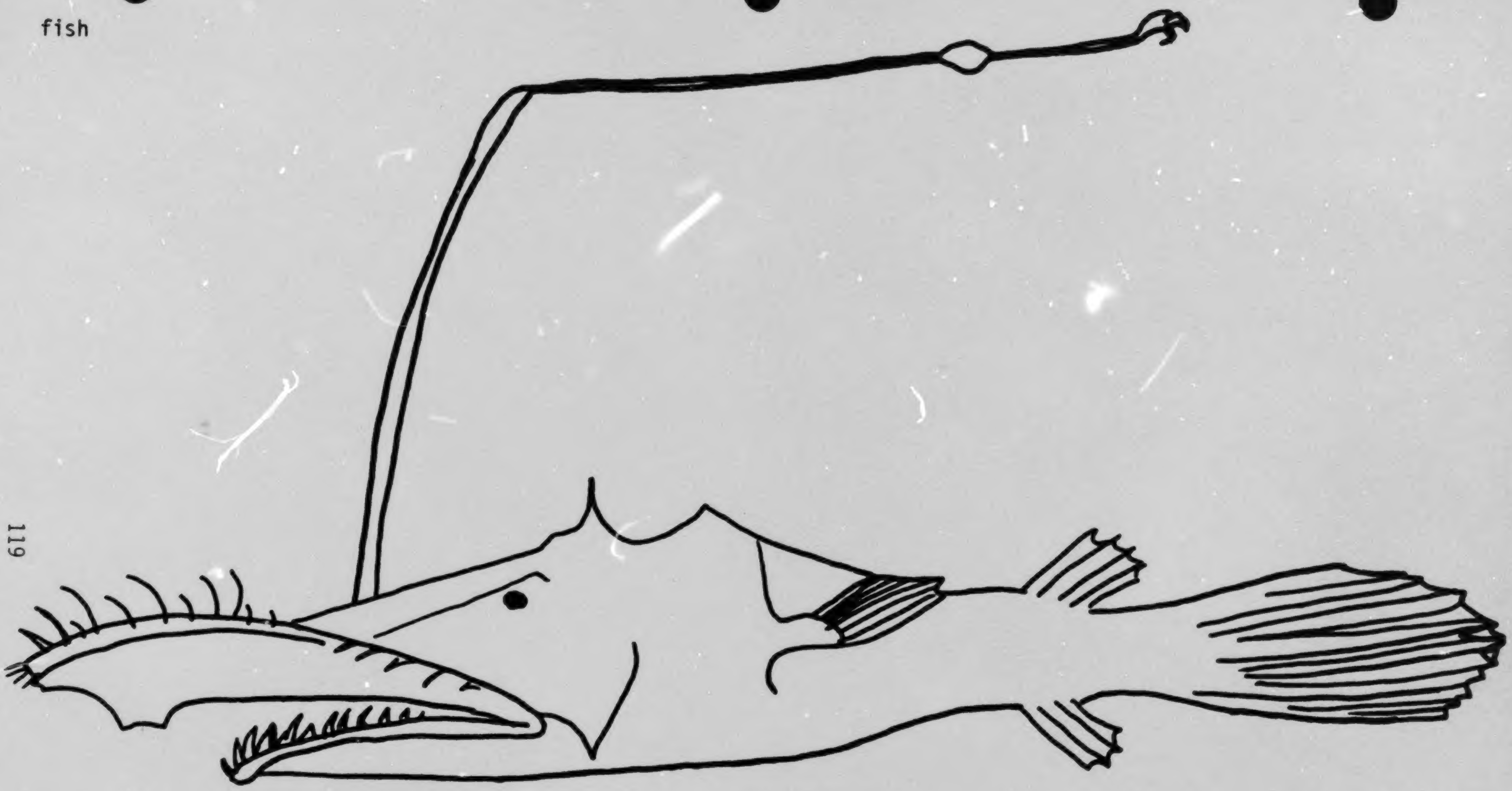
1. Draw a line over the fin used for power.
2. Circle a fin that is like an airplane's wing.
3. Draw a heavy black line on the fish's gill flap.
4. Color your fish.

fish



A strange fish from the ocean bottom.

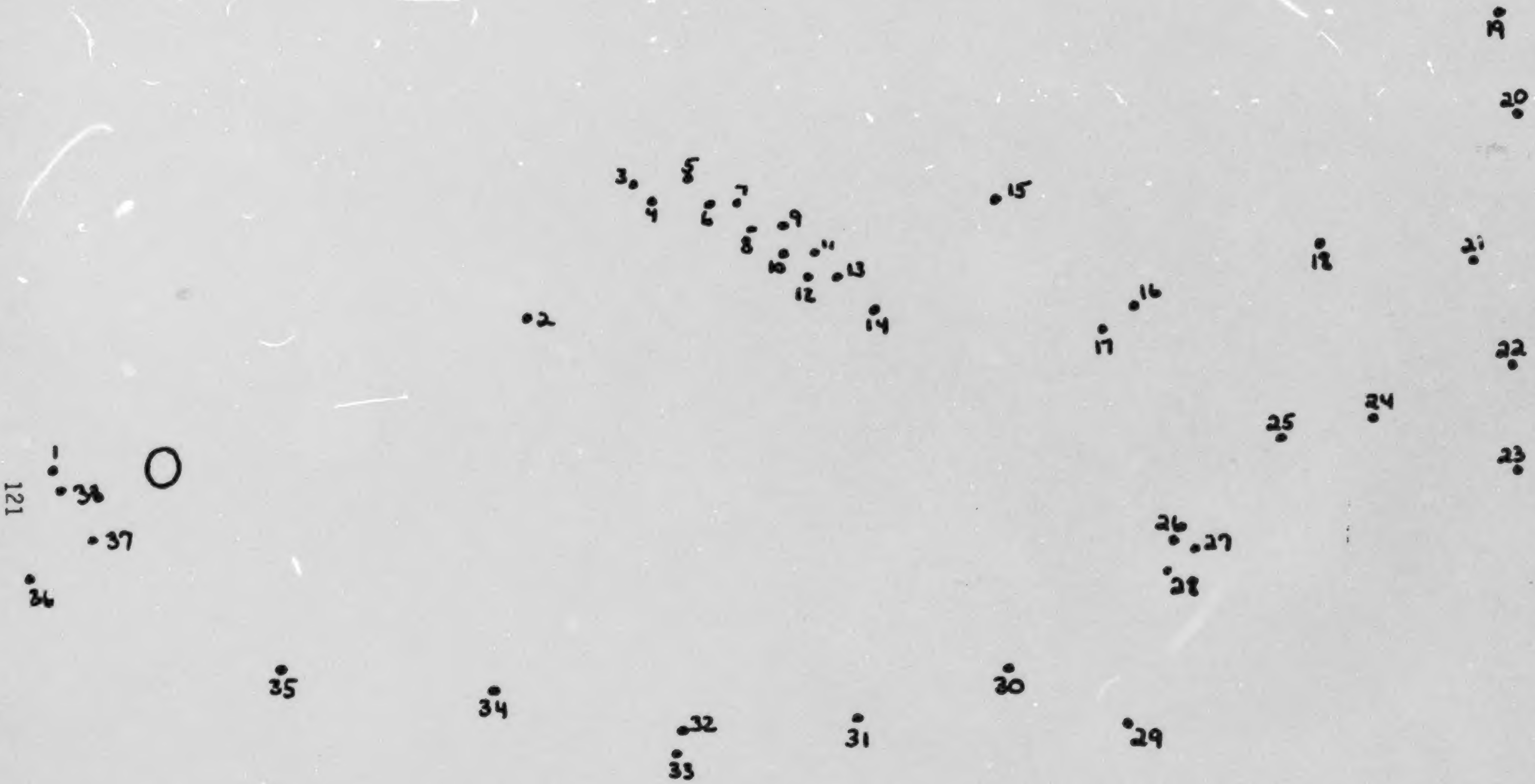
1. Give this fish a name. "Hi! My name is ______________________________."
2. Color the eye dark blue.
3. Circle the pectoral fin.
4. Color your fish a dark brown color that would help it hide.



An angler is a fisherman. I'm called an angler fish. Can you guess why?

1. Color my "fishing pole" brown.
2. Draw a red arrow showing the direction of my bottom teeth.
3. Color me so I can hide in the dark ocean bottom.

fish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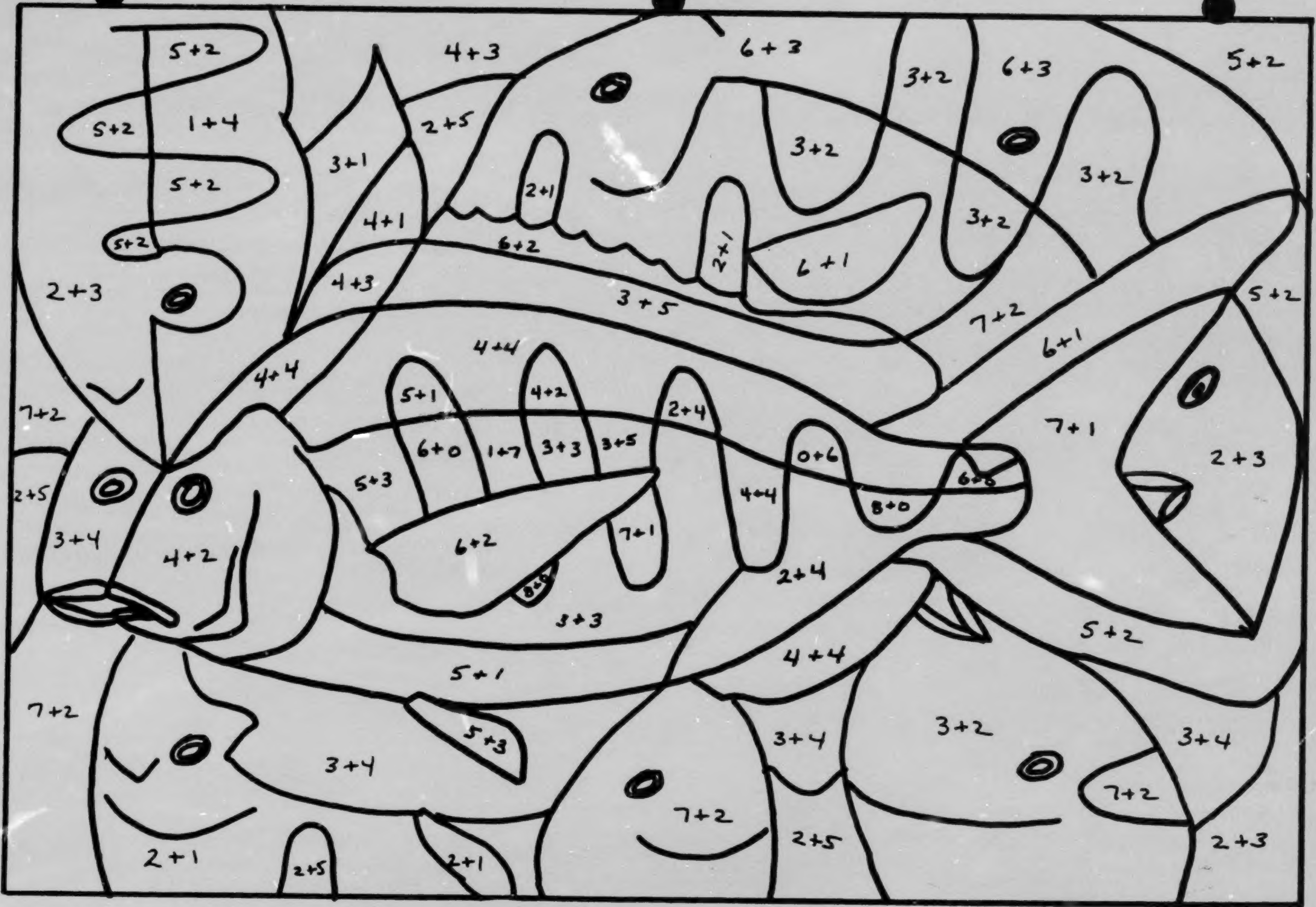
38

I swim in the ocean. I like to tease baited hooks.
What am I? ______________________

*From the Wetlands Institute, Cape May Co., New Jersey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6+0
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6+2
7+1
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5+1
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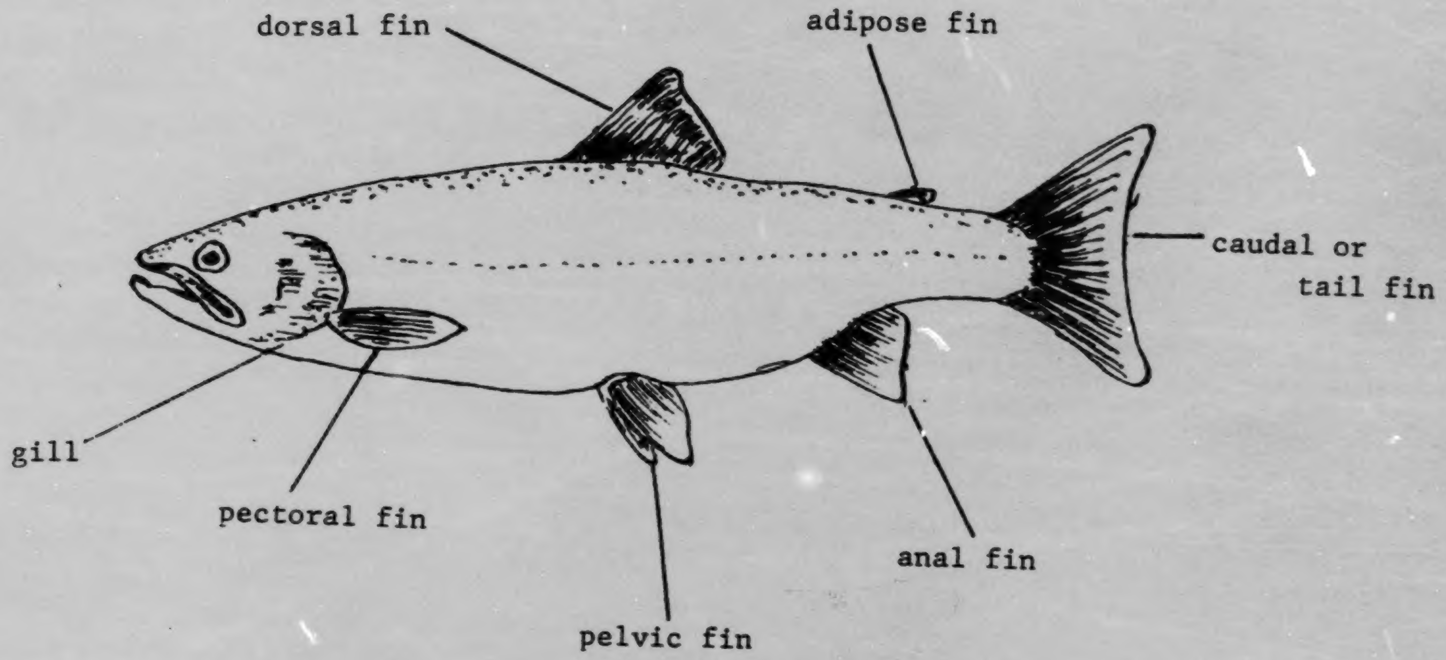
2+5
2+1

Color green the areas where the sum = 6
Color blue the areas where the sum = 8

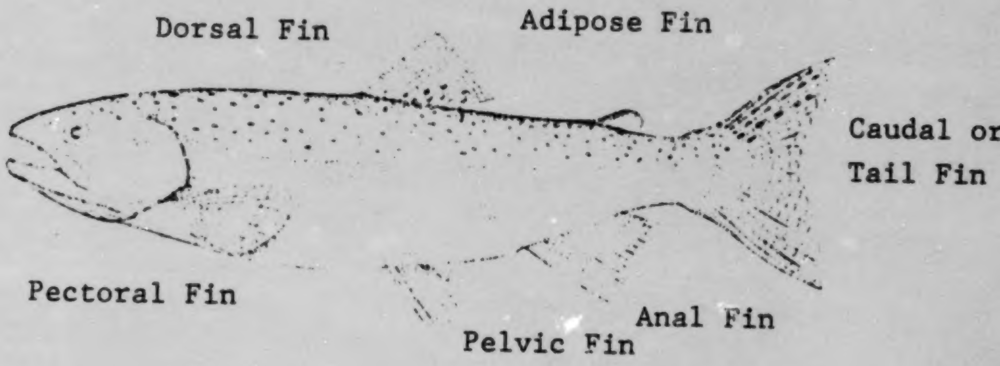
overhead


dorsal fin
adipose fin
caudal or tail fin
gill
pectoral fin
anal fin
pelvic fin

Name ______________________________ Page 1

FISH

How many fins do you think a fish has? Why don't you count them?


Dorsal Fin
Adipose Fin
Caudal or Tail Fin
Pectoral Fin
Pelvic Fin
Anal Fin

1. This fish has ________________________________fins.

Each fin has its own job to do. The fish uses the tail fin or caudal fin for steering and power. The fish uses his pectoral fins like an airplane's wings. These fins control his ups and downs.

2. Which fin do you think he uses to keep himself from rolling over? ____

Compared to many sea animals fish are very fast. Swimming fast helps them catch their food and escape from their enemies.

3. Which fin supplies the power for fast swimming? ____________
____
____

Name ______________________________ Page 2

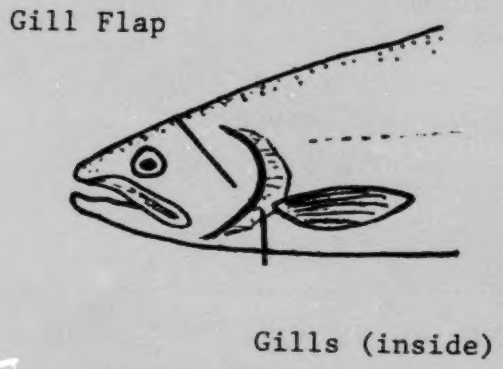
Some fish swim in large groups called schools for protection.

4. How can being in a school give a fish protection?

____

____

All animals need oxygen to live. Our lungs take oxygen out of the air. The gills of a fish are used to take oxygen out of the water.



A side view of a fish showing
one of his gills

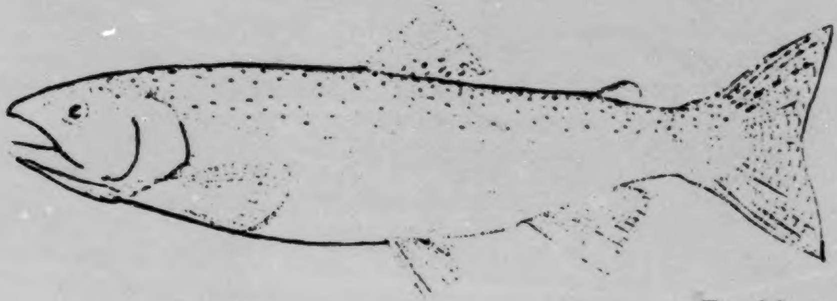
5. How are gills like lungs?

____

____

Name ______________________

Each fish has its own life story. Salmon return to fresh water streams to lay their eggs. The baby salmon live in fresh water streams. They then go to the sea to grow up.



Salmon

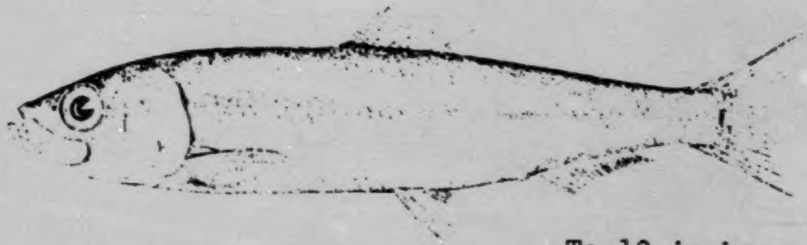
To 38 inches or about
1 meter in length

6. Where are salmon born?

____

____

Herring lay their eggs on seaweeds.

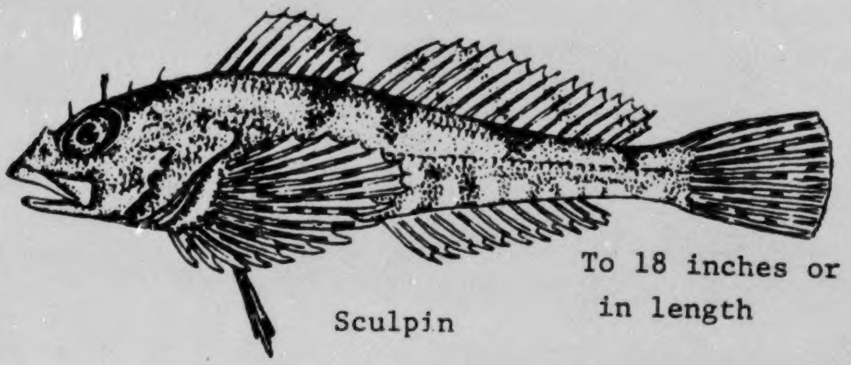


Herring

To 10 inches or 25 centimeters
in length

Name ______________________________

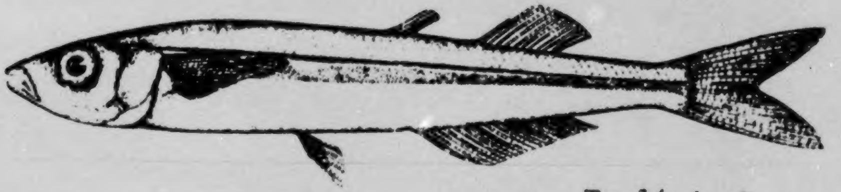
Sculpins are sometimes called bullheads. They often lay their eggs on the bottom side of rocks. This helps to protect them.



Sculpin

To 18 inches or 45 centimeters in length

Grunions or smelt bury their eggs on sandy beaches.



Smelt

To 14 inches or 36 centimeters in length

7. Circle the fish which would be hurt if all the rocks were removed from the beach.

Herring Sculpin Grunion

Fish are good to eat. If man catches too many there might not be enough to lay eggs for next year.

Name ______________________________

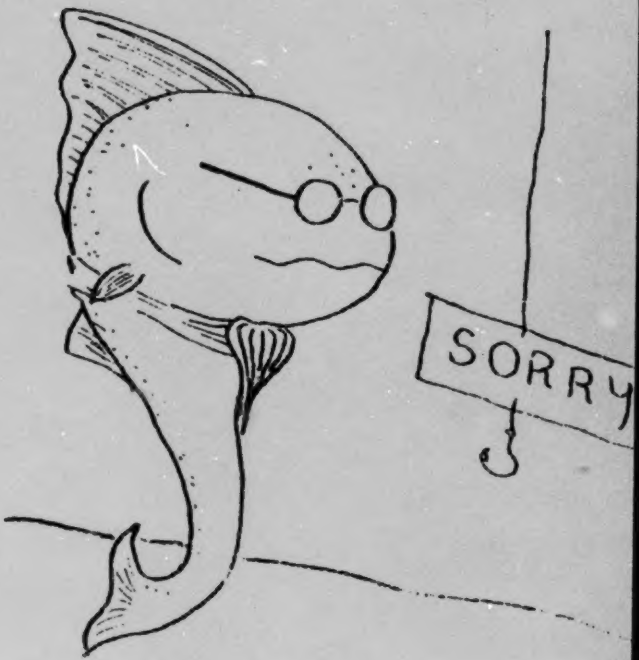
8. What can happen if we overfish?

____

____

____

____



TEACHER BACKGROUND - Fins

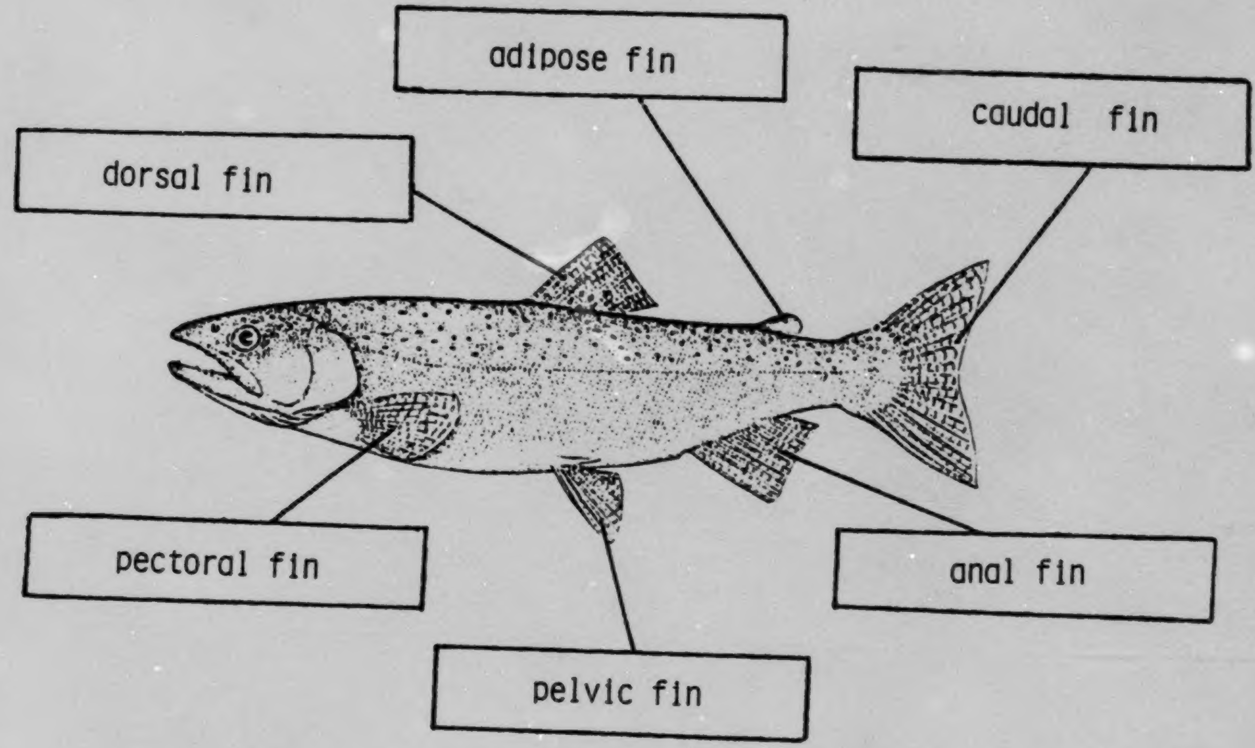
This exercise is designed to reinforce some of the vocabulary introduced in the section.

The fish shown in "Fins" is the same as the fish in previous student text "Fish" so students should have little trouble indentifying the various fins. You may elect to have your students write the fin name in the box rather than cutting and pasting. Each approach has its merits.

Duplicate the activity. One copy per student is recommended. Students may work independently or in small groups at the discretion of the teacher.

Reserve a few minutes for discussion of the basic concepts covered and to provide the correct answers. Use this opportunity to relate the function of the fin to its structure and location. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

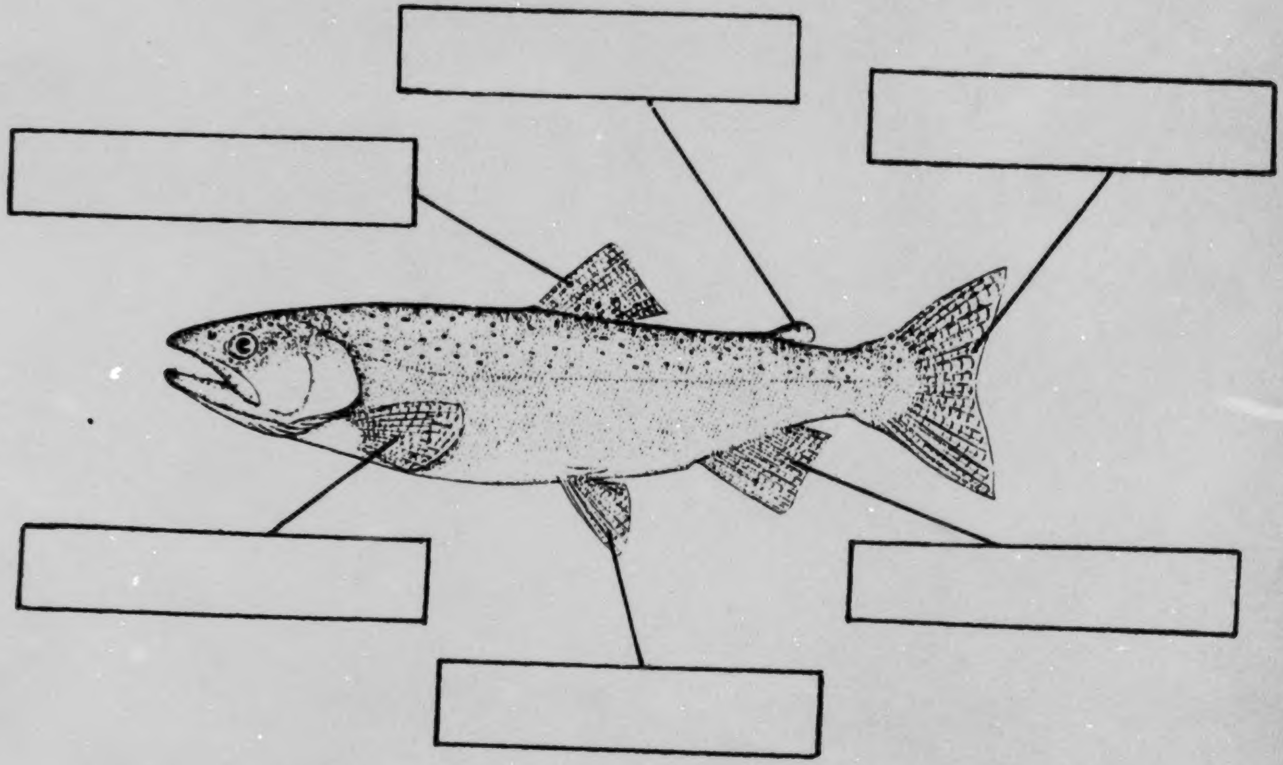


KEY WORDS - The key words are the fin names reinforced by this activity.

Name ______________________________

FINS

Label the fins on the fish below. Use the boxes at the bottom of the page.



adipose fin	anal fin	dorsal fin
cuudal fin	pelvic fin	pectoral fin

TEACHER BACKGROUND - Heads, Tails or Scales

This take-apart fish is designed to help your students become familiar with the various parts of a fish and with the function of these parts.

To use the fish puzzle for demonstration, rubber cement the pages to pieces of heavy paper or cardboard and then cut along the heavy black lines. Assemble the pieces on a large piece of paper and trace the outline. The fish pieces can be assembled on a bulletin board using push pins or a blackboard, using tape as you discuss the parts. It is also possible to use the take-apart fish as an individual student activity. Simply duplicate the parts pages on heavy paper and have the students assemble their own fish. The pieces can then be glued to a large piece of paper and colored. The finished products can decorate your classroom before they are sent home to parents. If you have each student make their own puzzle, plan to allow time to discuss the various parts using the information below.

Jig-Saw puzzle parts:

1. TEETH

   Not all fish have teeth. Some fish swallow their food whole. Those that do have teeth exhibit a wide variety...some with big sharp teeth to catch and hold prey, others with bristly teeth to scrape off algae, or flat and heavy teeth for crushing hard-shelled animals.

2. MOUTHS

   There are big mouths, tublar mouths, flexible mouths, mouths that point up and mouths that point down...all with special functions for that fish, depending on its environment, the food it eats and how it protects itself.

3. NOSTRILS

   Yes, fish do have noses. They are used to smell chemicals in the water, not for breathing. Some fish have one nostril (a blind sac) on each side of their face. Others have two nostrils on each side, forming a tube through which the water circulates. Some fish are able to smell things located miles away.

4. EYES

   Size and color vary from fish to fish. Most fish lack eyelids since their eyes are constantly bathed in water. (Some sharks are the exception). Fish lack sharp vision...they're nearsighted, and some cave fish lack eyes completely.

5. GILL COVER or OPERCULUM

   This flap covers and protects the delicate red gills found underneath. Fish get their oxygen from air dissolved in the water. This can be compared with mammals such as seals and dolphins which must surface periodically to breathe.

6 & 7. DORSAL FIN(S)

Some fish have one, some have two, some have none at all. There is a great variety in fins and their uses in fish. Mammals that live in the water, do not have fins, but have modified legs referred to as flukes or flippers.

8. CAUDAL FIN

This is the fish's tail. Some fish move their bodies by thrusting the tail back and forth. For other fish, the tail serves as a rudder or a stablilizer, with propulsion coming from body movements or other fin movements.

9. ANAL FIN

This fin is sometimes armed with sharp projections. When these supporting rods in the fins are soft, they are called rays. When they are hard and stiff, they are called spines.

10. PELVIC FINS

These fins are analagous to our legs. They are primarily used for fine adjustment of the fish's movements but may be modified for special functions, such as crawling along the bottom, holding or grasping.

11. PECTORAL FINS

These are analagous to our arms and are also used for fine movements. They may be modified for special functions or, in some fishes, absent.

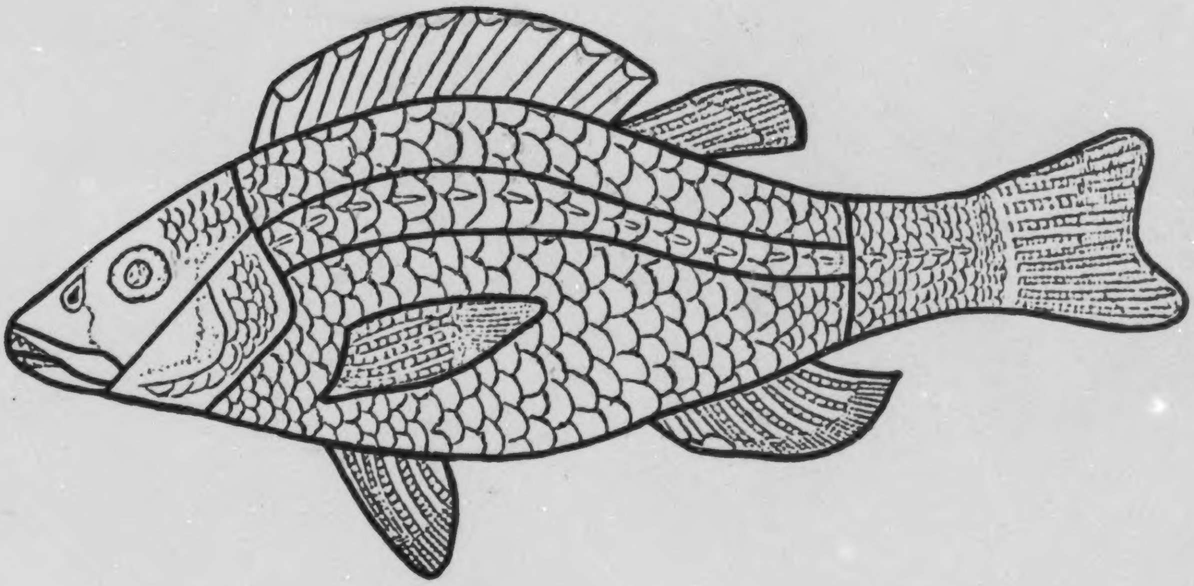
12. SCALES

Although most fish have scales, certain kinds either lack them or have such small scales that they are not noticeable, such as with the catfishes and moray eels. Scales are modified skin cells and help protect the fish from abrasion and skin diseases.

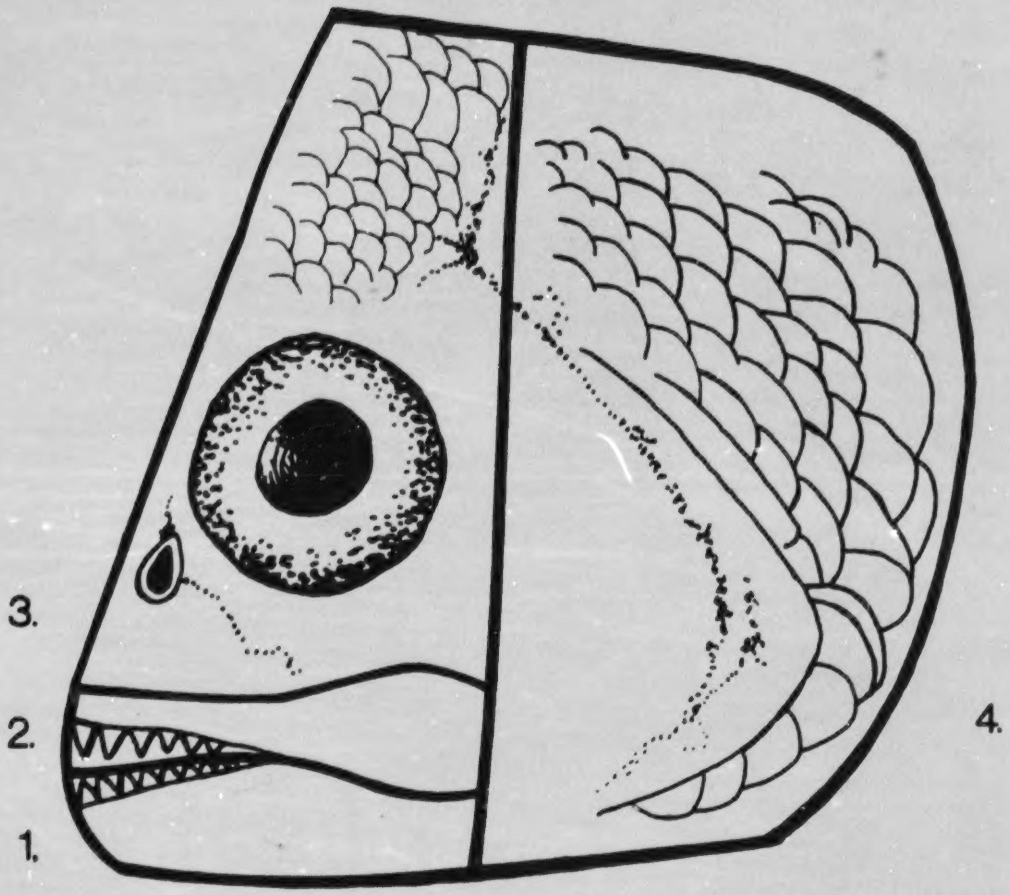
13. LATERAL LINE

The water fishes live in is sometimes turbid, usually in motion and often dark. Therefore, some fish don't depend on sight. Instead, they use a special sense organ, the lateral line. This is a series of pits in the skin that looks like a dotted line. The nerve cells in these pits are sensitive to changes in pressure and tell the fish how deep it is, how wavy it is and what sounds are present. It's also sensitive to chemicals dissolved in the water. Sometimes it's even sensitive to electrical fields, and works as a sort or radar.

KEY:



The take-apart fish puzzle was developed at the Helen Shedd Keith Aquatic Science Center of the John G. Shedd Aquarium, 1200 S. Lake Shore Drive, Chicago, Illinois 60605.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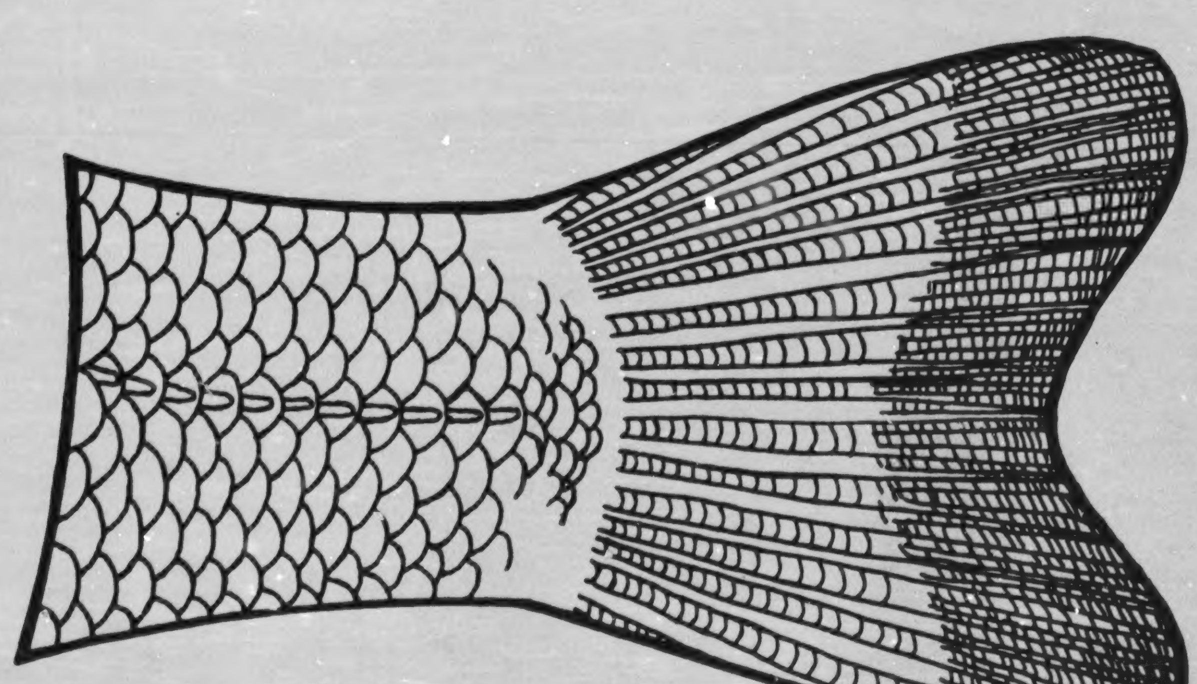
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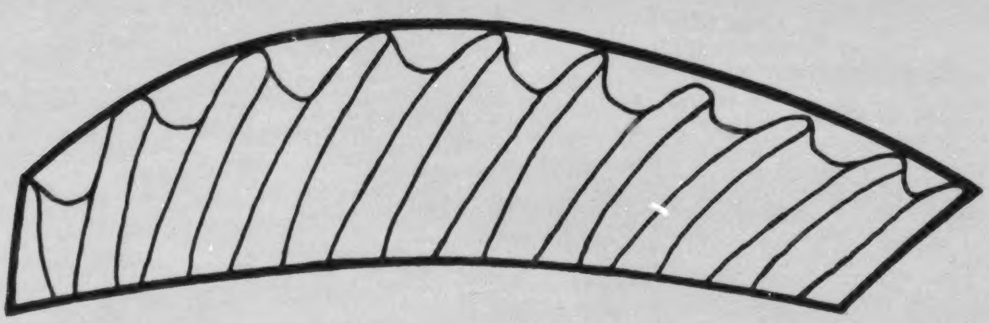

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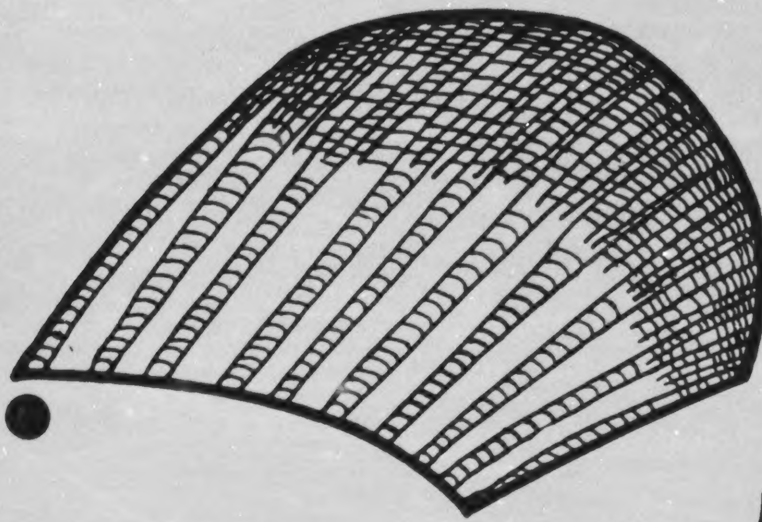

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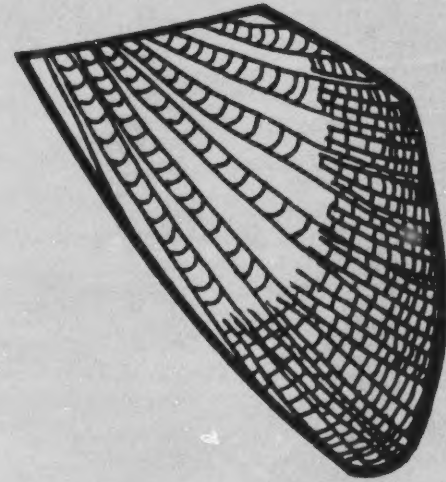

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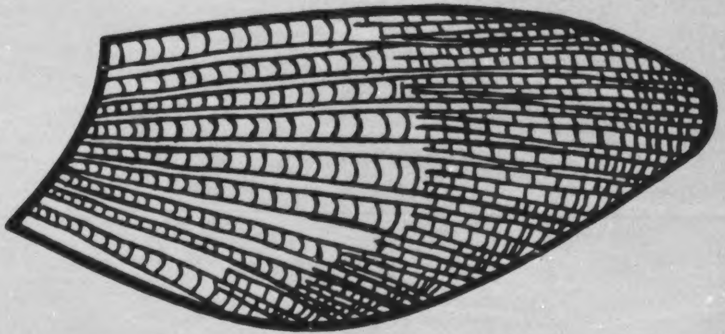

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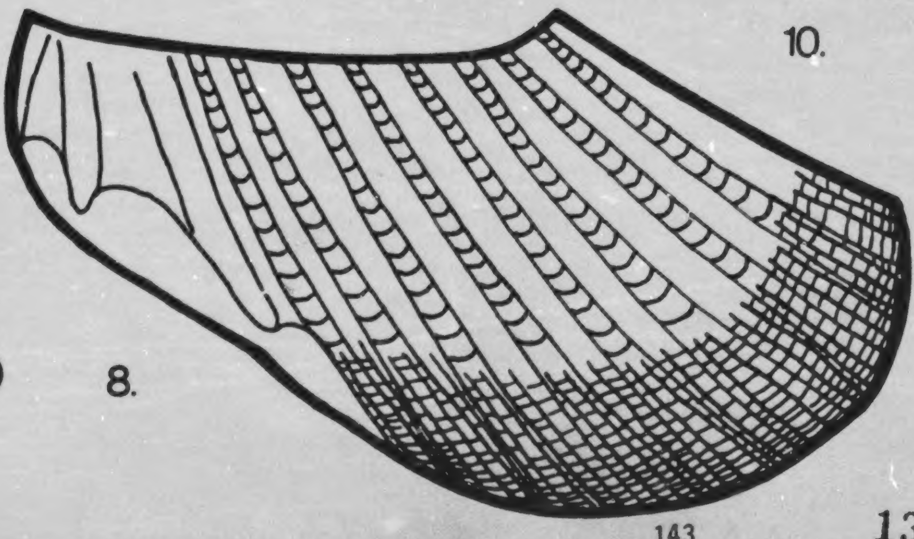

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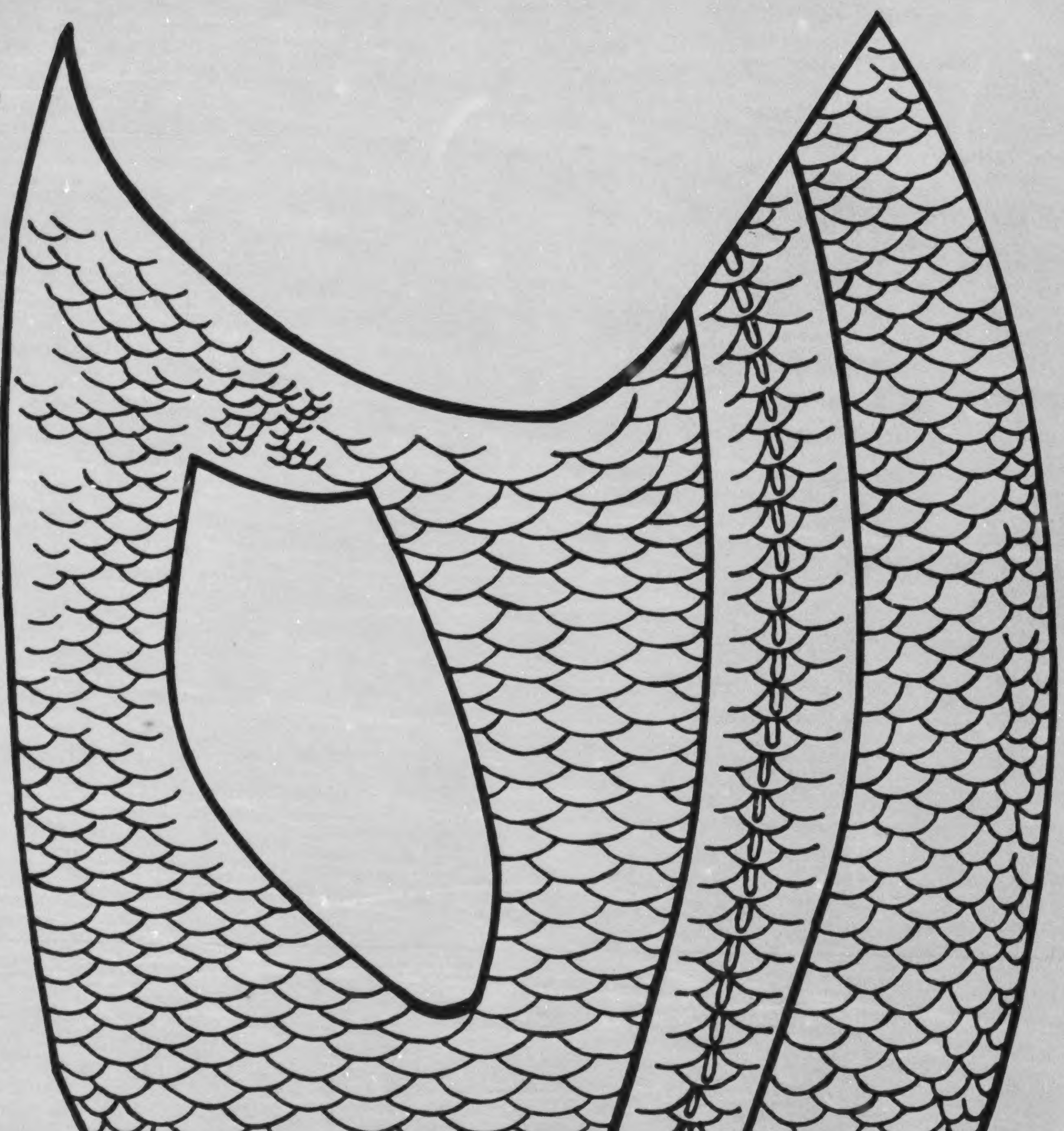

11.
12.
11.

TEACHER BACKGROUND - Going Fishing

This is a fun activity that can add color to your room while teaching something about fish anatomy. As the children make their fish, utilize the opportunities that arise to relate structure (eg. streamlining) to function (swimming fast, etc.)

Duplicate the activity pages. One set per student is recommended. This activity can be demonstrated, but there is something to be gained by having the students follow the steps of the procedure on their own. Provide lots of pictures of fish for motivation and ideas. The "Key Words" should be taught if they are unfamiliar to your students.

KEY WORDS

fold

lengthwise

staple

widthwise

Name ______________________________

GOING FISHING

Now that you know about fish, let's make one! Here are the things you will need.

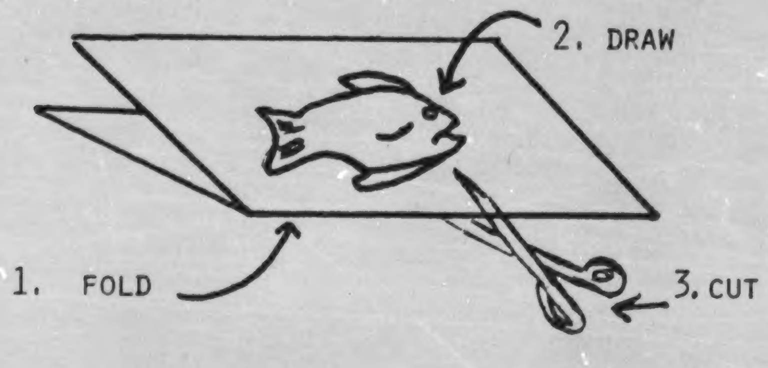
Materials:

paper - butcher, or construction
paper - waste or newspaper
crayons or paint
glue
construction paper - scrap
stapler
string
scissors

Here is how you do it.

Procedure:

1. Fold your piece of paper in half (either lengthwise or widthwise).
2. On one side of the folded paper, make a drawing of your favorite fish.
3. Start at fold and cut out the fish. Cut both sides of the folded paper at once. You will have two fish when you have finished.

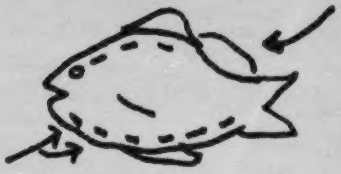


4. Color or paint both fish and/or decorate with colored paper. Add fins, tails etc.

Name ______________________

5. Staple the two pieces together around edge of fish leaving an opening.

6. Stuff fish with waste paper or newspaper.


6. STUFF AT OPENING
5. STAPLE
(LEAVE OPENING)

7. Staple opening.

8. Hang by string.

9. Enjoy your creation.

TEACHER BACKGROUND - Fishwich Crossword Puzzle

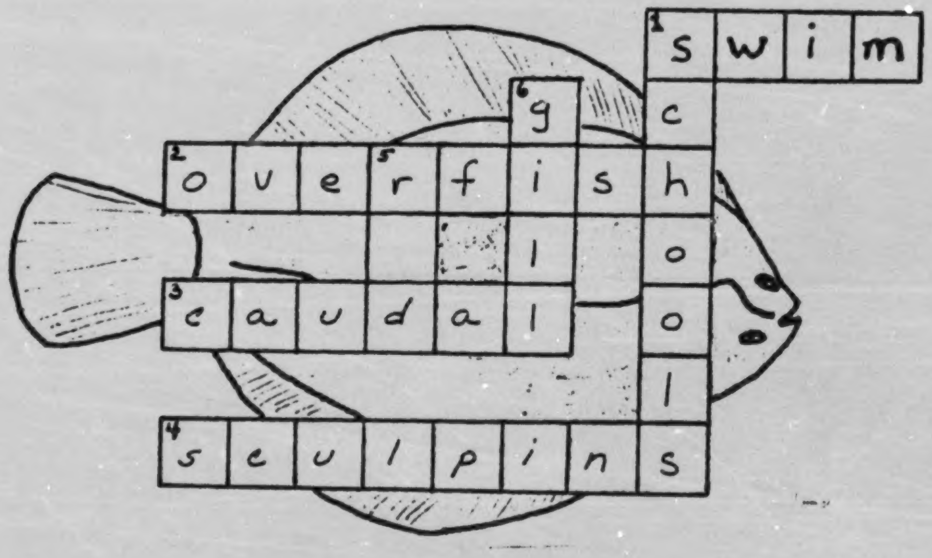
The "Fishwich Crossword Puzzle" is designed to help reinforce vocabulary words introduced in the worksheets. Many of your students may not be familiar with this type of puzzle. Provide as much help as is necessary to get them started. The puzzle is not complex. The clue words are listed next to the puzzle.

The fish is a C-O sole (for curious students). It lives on the bottom and and is flattened to the point of having both eyes on one side!

Duplicate the crossword puzzle. One puzzle per student is recommended. Students may do this activity individually but much is to be gained by having them work in small groups. Be certain that your students understand how to do a crossword puzzle. You may elect to have them work individually and then, meet in small groups for mutual aid on problem words. Choose the method suited to your class.

Allow a few minutes for discussion of the basic concepts covered and to provide the correct answers. Use this time to summarize the ideas presented in the section on fish. The "Key Words" should be taught if they are unfamiliar to your students.

KEY- Crossword Answers

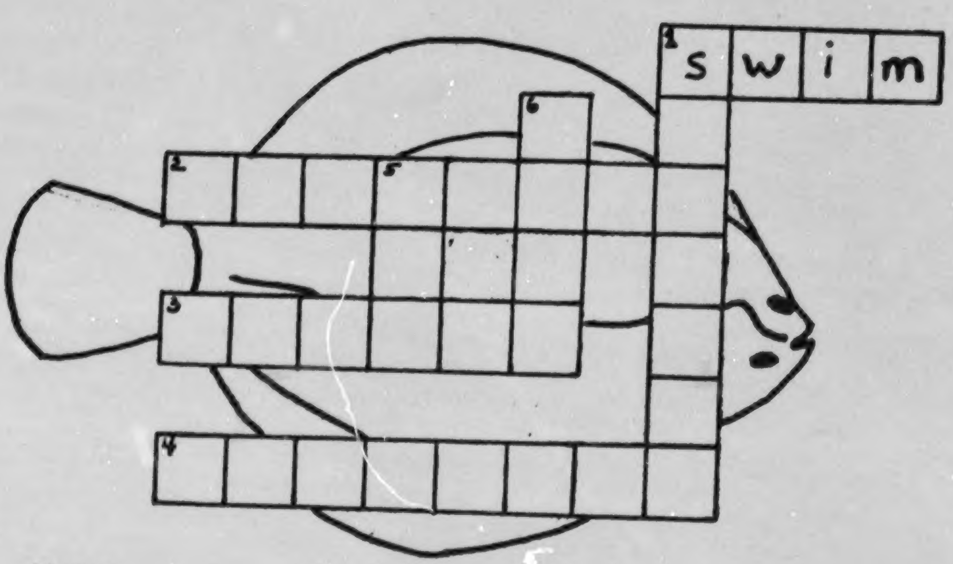


KEY WORDS - Are the answers to the crossword clues

Name ____________________

FISHWICH CROSSWORD PUZZLE

Each clue describes a word you learned about fish. Figure out each clue word. Write it in the row of boxes that begins with the same number as the clue. Clue number 1 across is done for you.



WORDS

dorsal
caudal
swim
gill
schools
ocean
lungs
sculpins
smelt
overfish
pole
rod

CLUES

ACROSS

1. Fins help a fish to ____________.
2. If we ____________ today, there will be no fish tomorrow.
3. This fin is used for power.
4. These fish lay their eggs on the bottom side of rocks.

DOWN

1. Some fish swim in ____________.
5. You can catch fish with a fishing ____________.
6. This is a fish's lung.

HINT: Most of the answers are underlined in your worksheets.

TEACHER BACKGROUND - Music

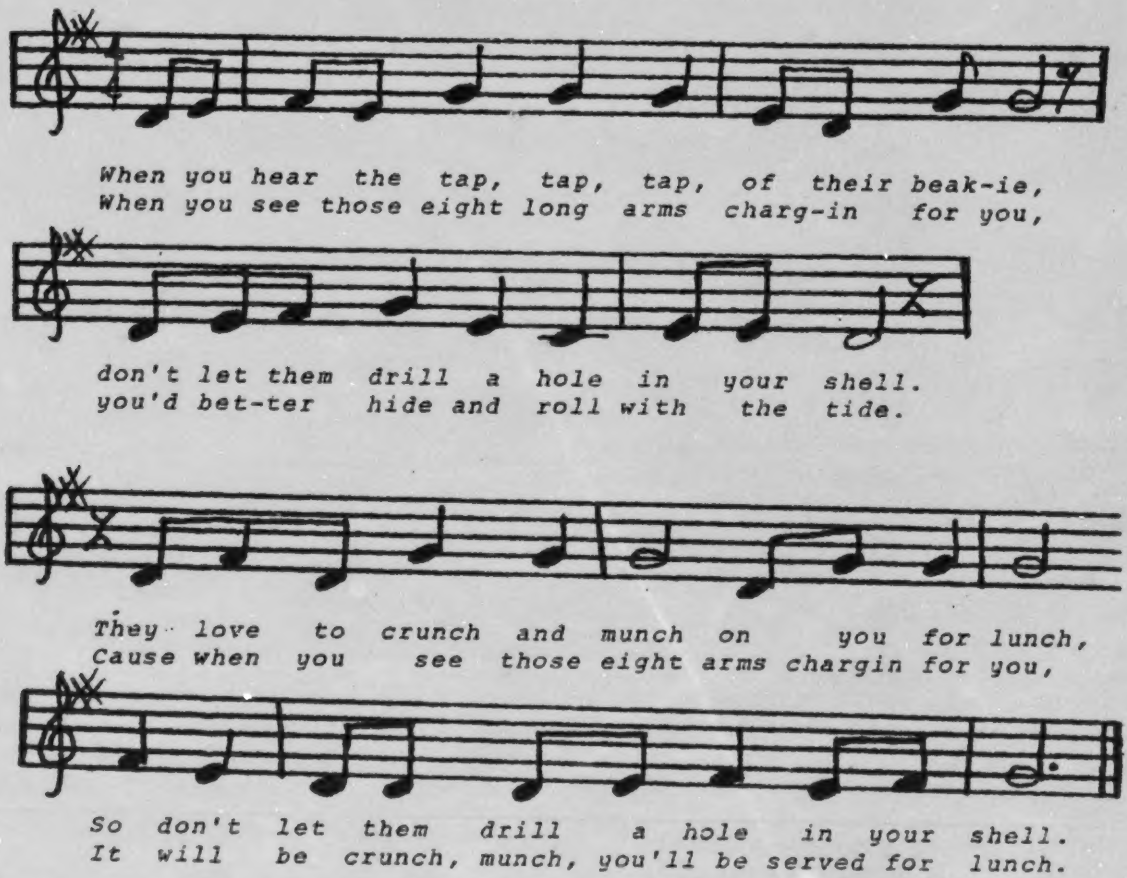
There is a saying, "music makes the world go around". In our underwater world of the so-called silent deep, water makes the music go around. The waves pound their melodic rhythm day and night on a sandy beach or wide swept rocky shore. The tides or currents so gracefully move the seaweeds in their sweeping to and fro rendition of underwater ballet. All this provides an atmosphere of symphony that can inspire even the unmusical scholar.

Almost every living creature in the sea makes noise. Many of the creatures of the sea endeavor to entertain the listener with beautiful melodious sounds as well as with their graceful rhythmic movements. The silent deep really is not silent at all.

You will find sea songs accompanying many of the following sections in Marine Science Activities. Your students should easily be able to identify with many of the sea songs included. You may wish to provide an opportunity for students to make up their own songs. For example, they may find it interesting to make up songs and sounds to fit the personality and physical features of each animal involved. This "TEACHER BACKGROUND" will serve for all of the music included.

The main purpose of these songs is to allow you to "marinate" your curriculum. The songs are fun and are usually received enthusiastically by the students. Incorporate them into your daily schedule as you see fit.

THE HUNGRY OCTOPUS


When you hear the tap, tap, tap, of their beak-ie,
When you see those eight long arms charg-in for you,
don't let them drill a hole in your shell.
you'd bet-ter hide and roll with the tide.
They love to crunch and munch on you for lunch,
Cause when you see those eight arms chargin for you,
So don't let them drill a hole in your shell.
It will be crunch, munch, you'll be served for lunch.

SEA ANEMONE

TEACHER BACKGROUND - The Sea Anemone

This section is the first of several that deal with marine organisms which are relatively unfamiliar to young children. Supplement the text and activities with pictures, and similar study aids.

Sea anemones are sometimes called the underwater flowers of the sea. However, they are not flowers at all but animals that look like beautiful flowers. They come in many pretty colors and shapes and sometimes appear to be growing in gardens. With their one large sucker foot they can attach themselves almost anywhere. Some even attach themselves to rocks or other things after burrowing down deep into the sand.

A sea anemone usually does not move from one location to another, but on occasion they have been known to travel from one end of the aquarium to the other overnight.

Sea anemones apparently have few, if any, enemies. They have been known to live for at least 80 years while in captivity and have a variety of ways of reproducing themselves. Even so they don't seem to become overpopulated.

As a predator, the sea anemone often waits for long periods of time until some unsuspecting prey stumbles into its trap of stinging tentacles. Although these stinging cells are deadly to small fish and the like, they are completely harmless to the skin of even the most sensitive humans.

An interesting activity for the students is to touch the tentacles of the sea anemone with their fingers and observe the sea anemone withdraw. The students may also wish to occasionally feed the sea anemone by placing small pieces of meat or clam etc. on the tentacles of the sea anemone and observe it taking them into its mouth.

The sea anemone is one of many marine animals that become exposed during a low tide. The sea anemone traps water and moisture inside to provide it with oxygen and prevent it from drying out during low tide.

Duplicate the text pages. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. The "Key - Words" should be taught if they are unfamiliar to the students. Coloring work sheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

Like all of the sections, "The Sea Anemone" provides opportunities for creative writing and creative dramatics. You can "Marinate" your curriculum by choosing marine oriented topics for your classroom activities. For example, creative writing about "My life under the sea" or "What it would be like to Scuba dive" or "My day as a sea anemone". You can use creative dramatics by having your students conduct body movements to show the actions of the tentacles of a sea anemone". You can use creative dramatics by having your students conduct body movements to show the actions of the tentacles of a sea anemone feeding or closing for protection when the tide goes out. Use your imagination to infuse your daily activities with marine studies.

Coloring worksheets follow this "Teacher Background Section". They are for reinforcement. They should be used after the text has been studied.

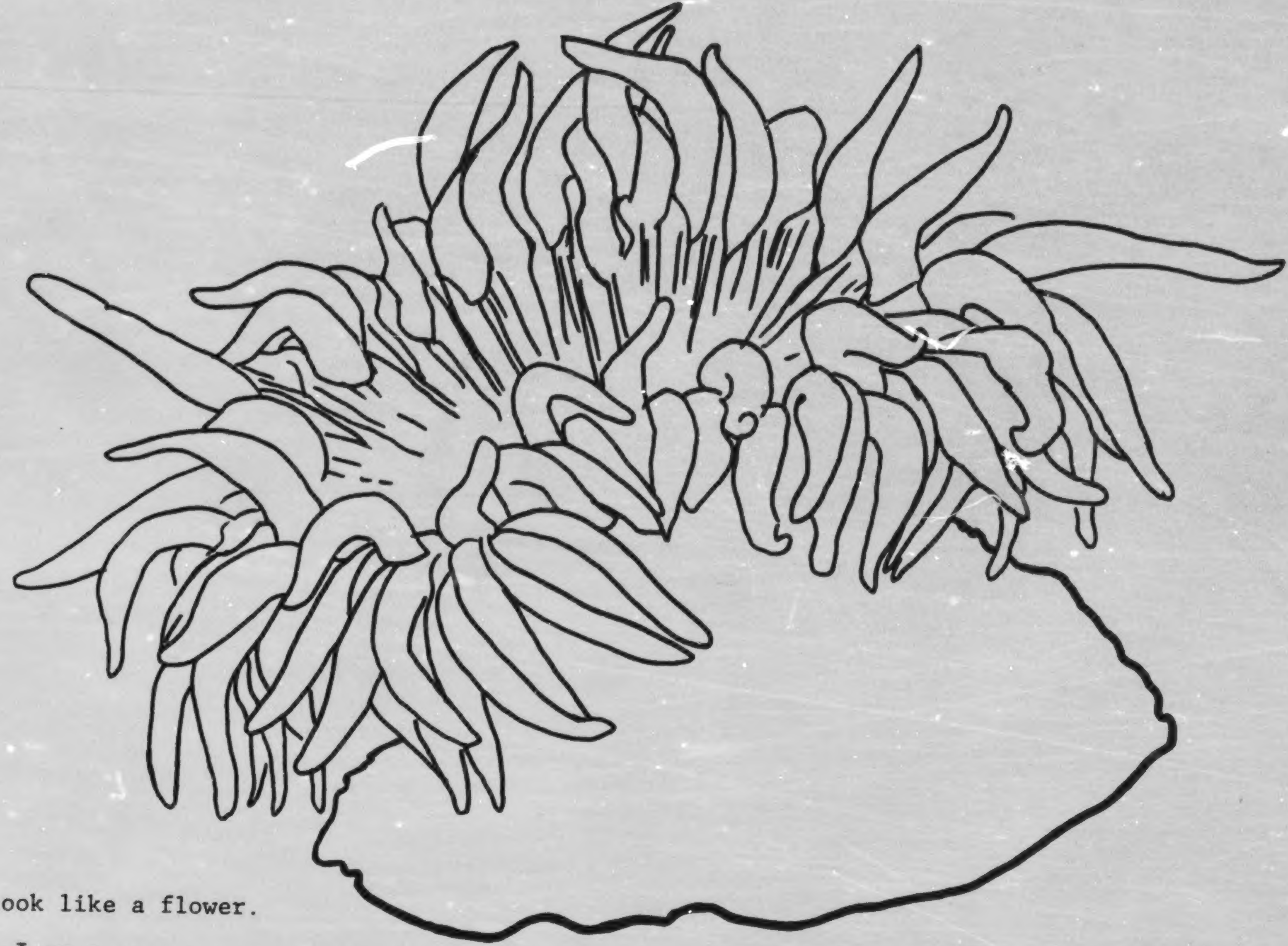
KEY - Text questions

1. The bottom of the sea anemone's body is called the foot.
2. The sea anemone gets its food by stinging other animals with its tentacles
3. The shells and stones help camoflage the sea anemone and enable it to hide from enemies. Your students may suggest that the shells also serve as a suit of armor. Either answer is reasonable.
4. The answer depends upon the experiences of your students. You can supplement their experiences with pictures etc.

KEY WORDS

foot
sea anemone
sticky
stinging
stump
suction
tide flats
tentacles
tube
wharf pilings

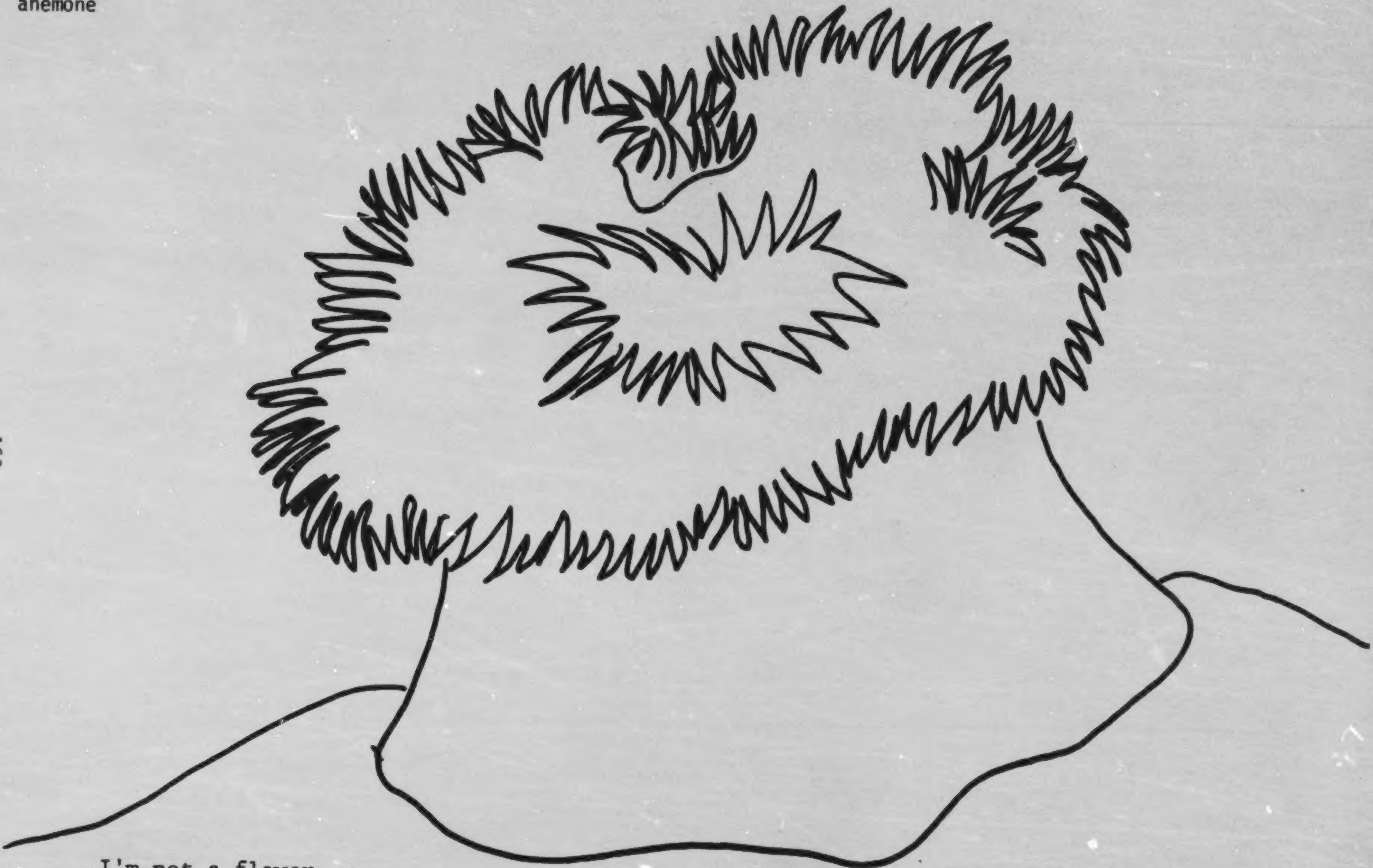
anemone



I look like a flower.

1. I am a __________ ____________________.
2. Color me.

anemone



I'm not a flower.

1. I am a ________ ____________________.
2. What do I eat? ______________________________
3. Draw some food for me to eat.
4. Color me.

Name ______________________________

THE SEA ANEMONE

The sea anemone lives on the tide flats near the shore. It lives on rocks and wharf pilings. The bottom of its body is called the foot. The foot lets the sea anemone stick to the rocks and wharf pilings by suction.

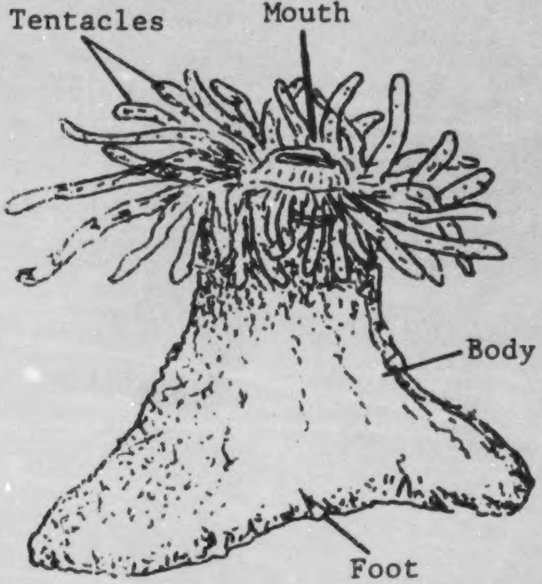
1. What is the bottom of its body called?

   ____

   ____

   ____

   ____



A Sea Anemone

The sea anemone can be many colors. It has a round tube body. On top of the tube are many tentacles. The tentacles make the sea anemone look like a flower. The tentacles can sting. The sea anemone gets its food by stinging other sea animals almost as big as itself.

2. How does the sea anemone get food? ______________________________

   ____

Name ______________________

Some sea anemone's have bodies which are sticky. Shells and stones stick to them. This protects the sea anemone from harm.

3. How might these shells and stones protect the sea anemone? ______________
____
____
____

Some sea anemones like to live together in groups. They help each other stay wet when the tide is out. When sea anemones are in danger, they pull in their tentacles. They look like a stump. Sometimes the sea anemone hides under the sand.

4. Have you ever seen a sea anemone? ______________________
____

Where? ______________________
____

TEACHER BACKGROUND - Sea Anemone

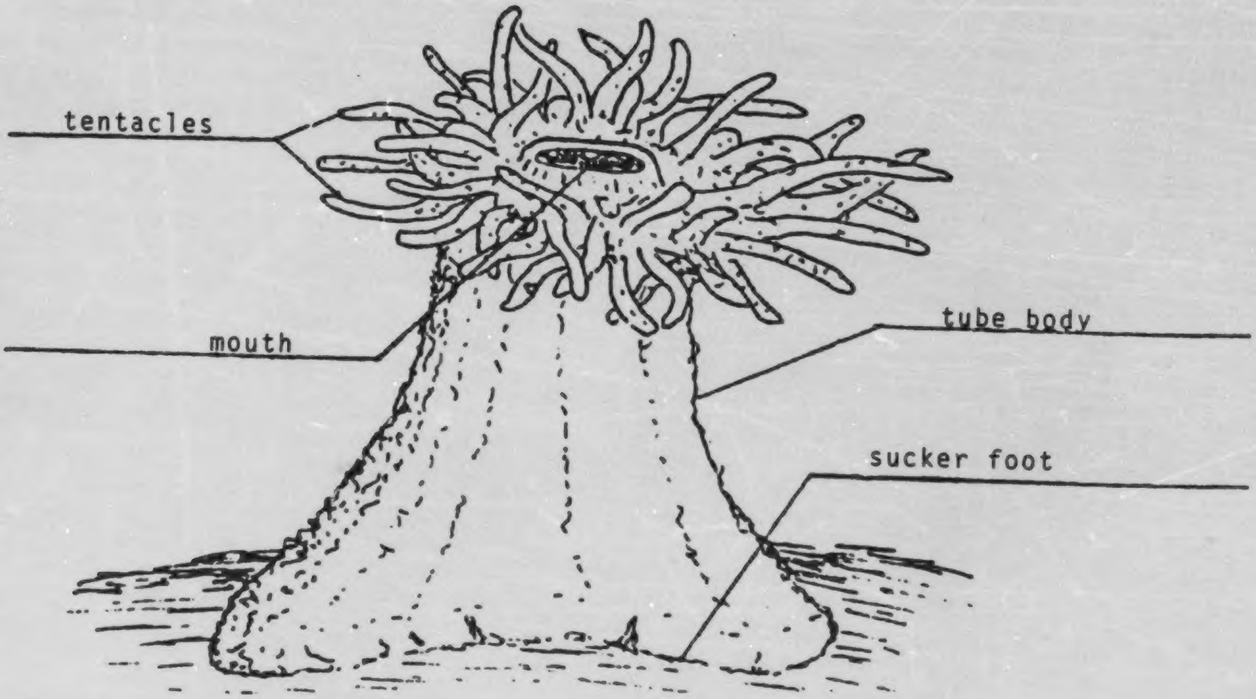
This exercise is designed to reinforce some of the vocabulary introduced in the section.

The sea anemone shown is the same as the sea anemone in the previous text section so students should have little trouble identifying the various parts.

Duplicate the "Sea Anemone" activity page. One page per student is recommended. Students may work independently or in small groups at the discretion of the teacher.

Reserve a few minutes for discussion and to provide the correct answers. Use this opportunity to relate the function of the body part to its structure and location.

KEY

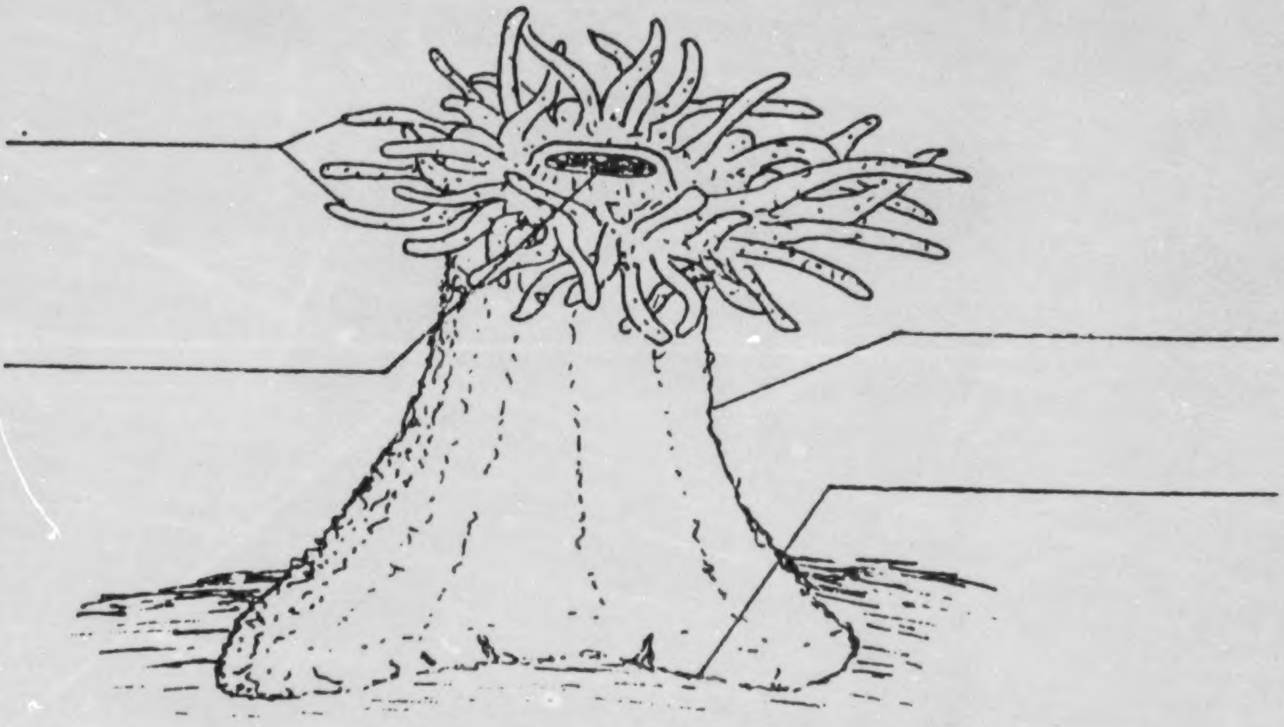


KEY WORDS

The key words are the names of the body parts reinforced by this activity.

Name ______________________________

SEA ANEMONE



1. Use these words to label your picture:

mouth	tube body
tentacles	sucker foot

2. Now color your sea anemone.

TEACHER BACKGROUND - The Incomplete Sea Anemone

This activity helps to evaluate student learning of the concepts presented in "The Sea Anemone" section. All of the questions require literal level information which is found directly in the text.

Duplicate the activity. One set per student is recommended. The students may work on this exercise individually or in small groups. They may use the text for verification of the answers as you see fit.

Provide a few minutes upon completion for a discussion of the basic concepts covered and the correct answers. Use this discussion as a summary of the ideas presented in the section. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

1. The sea anemone lives ______on the rocks______.
2. Other animals get ______stung by its tentacles______.
3. The sea anemone has a shape like a ______round tube______.
4. A ______sucker foot______ helps the sea anemone.
5. The sea anemone ______pulls in his tentacles______ when it is afraid.
6. The sea anemone is an ______animal______.

KEY WORDS

afraid
animal
sea anemone
shape
stung
sucker foot
tentacles
tube

Name ______________________________ Page 1

THE INCOMPLETE SEA ANEMONE

Cut out and paste the words on the next page to make sentences.

1. The sea anemone lives ______________________________.
2. Other animals get ______________________________.
3. The sea anemone has a shape ______________________________.
4. A ______________________________ helps the sea anemone stay on a rock.
5. The sea anemone ______________________________ when it is afraid.
6. The sea anemone is an ______________________________.

Name ______________________________ Page 2

Cut the following words out to paste onto the blank spaces on page 1.

animal

on the rocks

sucker foot

like a round tube

stung by tentacles

pulls in his tentacles

TEACHER BACKGROUND - Snail Tracker

If you have an aquarium (either marine or freshwater) set up with snails, "Snail Tracker" is an interesting lesson in rudimentary graphing. There are some things to be aware of, however. Snails tend to be somewhat unpredicatable: they may move fine on the glass for days at a time or they may drop off, or they may stand still (or any combination of possibilities). These unpredictabilities can provide many teachable moments-utilize them when they arise.

Duplicate the activity pages. One set is recommended per student. This activity lends itself well to demonstration and plotting on the chalkboard. It is also possible to have students do the activity individually or in small groups. After you obtain a sufficient amount of data to answer the questions, you may have the students answer the questions individually. Plan to provide some time at the end of the activity for discussion of results and to provide answers to the text questions. The "Key Words" should be taught if they are unfamiliar to your studnets.

KEY

6. a.-g. The answers depend upon the experimental results. The snail does not have to move in straight lines so it could (probably did) move much farther than the graph would show.

KEY WORDS

aquarium
distance
grease pen
snail
straight
total
tracker

Name ______________________________

SNAIL TRACKER

Look for a snail on the glass front of your aquarium. Let's see what we can learn. You'll need these things:

Materials:

grease pen or felt tip pen
ruler

Here is what you do:

Procedure:

Day 1

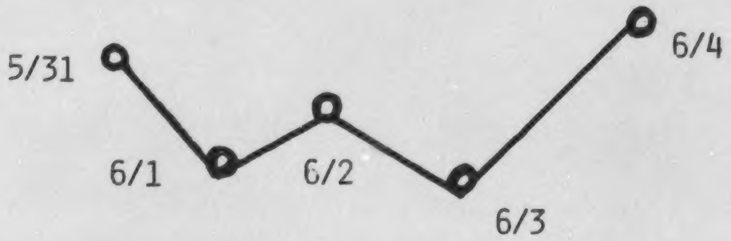
1. Make a circle around your snail on the outside of the glass. Use the grease pen.
2. Write the date next to the circle.

Day 2

3. Put a circle around your snail again today.
4. Write the date next to this circle.
5. Connect today's circle to yesterday's with a straight line.

Day 3, 4, 5

6. Repeat the above steps. Your snail tracker will look something like this:



Did your snail drop off the glass? If it did you can use the snail tracker above to answer these questions.

Name ______________________

a. How long was the longest day's move? ____________.

b. How short was the shortest day's move? ____________.

c. What was the total distance moved? ____________.

d. Could the snail have moved further than this distance? _____.

Explain your answer.

____

____

____

e. Does the snail always move in straight lines? ____________

f. Do you want to change your mind about the total distance the snail could have moved? Explain your answer. ____________

____

____

g. Look closely at your snail. What is it doing on the glass?

____

____

____

BARNACLES

TEACHER BACKGROUND - Barnacles

"Barnacles" offers a look at yet another marine inhabitant. Barnacles are familiar to most people who have visited the sea-shore. Focus on the adaptations barnacles have evolved to help them survive in the tidal zone as you go through the text and activities.

Anyone who has been to a beach has probably bumped into a barnacle or two at one time or another. Barnacles seem to be one of the things people find when they visit the beach. They have a prominent location attached to rocks in the upper tidal zone. Therefore, twice a day barnacles become quite accessible. Another reason for the frequent encounter is the shape and structure of the barnacle. A barnacle has sharp pointed shell-like covering plates and an unusual glue that is so strong that once the barnacle is attached to something it is almost impossible to remove. In fact, when moved the glue does not release but instead part of the shell is left behind.

In another way, the barnacle is unusual because his foot becomes his head or, better yet, his mouth. With his broom-like foot he sweeps water and plankton into his stomach and at the same time uses the gills attached to his legs to get oxygen out of the water. When the tide goes out the barnacle is able to seal enough moisture in with his shell-like plates to enable him to survive until the next high tide.

Duplicate the text pages. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. The "Key Words" should be taught if they are unfamiliar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

Provide pictures of barnacles. There is plenty of opportunity for creative teaching. For example, use creative dramatics to have your students conduct body movements to show the actions of the foot of a barnacle sweeping for food.

KEY - Text questions

1. Barnacles sometimes live on rocks, shells, boats or other animals. Any two of these choices will suffice.
2. Barnacles eat very small plants and animals (plankton) that drift in the water.
3. Fish are a familiar animal that use gills for breathing.
4. Barnacles don't like starfish because starfish eat barnacles. This is a good time to talk about predators helping to maintain "the balance of nature" by regulating the population numbers of their prey.

KEY WORDS

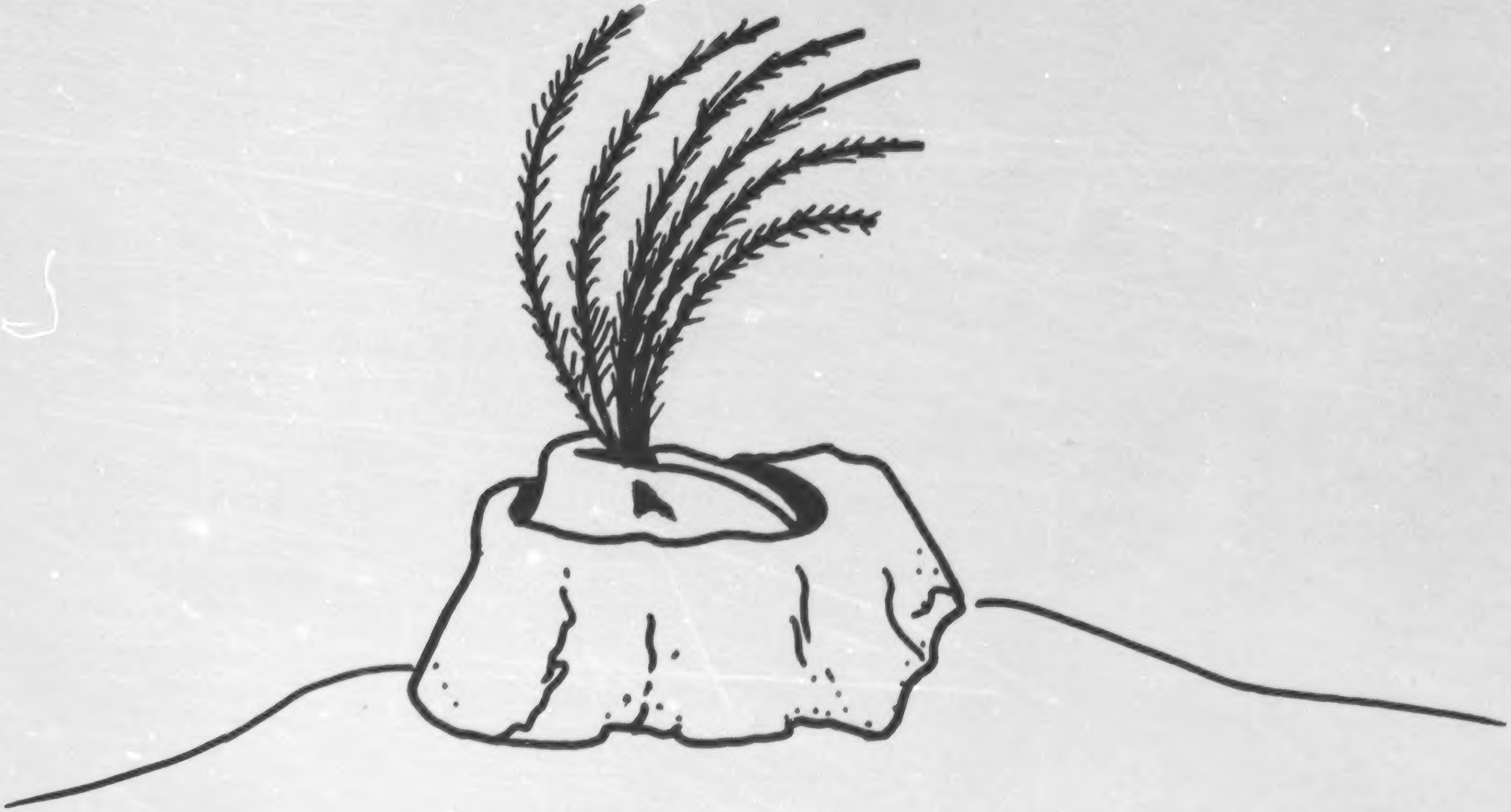
attached

barnacle

clusters

drift

feathery legs
gills
overrun
oxygen
plankton
shell
tide



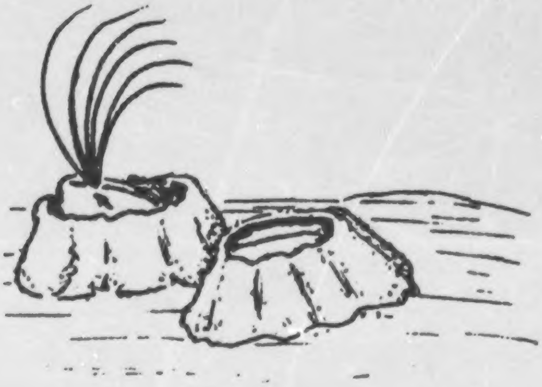
Fishing for food.

1. Color my legs red.
2. Draw in my food.
3. I am a ______________________.

Name ____________________________ Page 1

BARNACLES

Barnacles live on rocks, shells, and on other animals. Barnacles make a glue to attach themselves to almost anything. Fishermen do not like barnacles. Barncales grow on the bottom of their boats. The barnacles slow down the boat's speed.



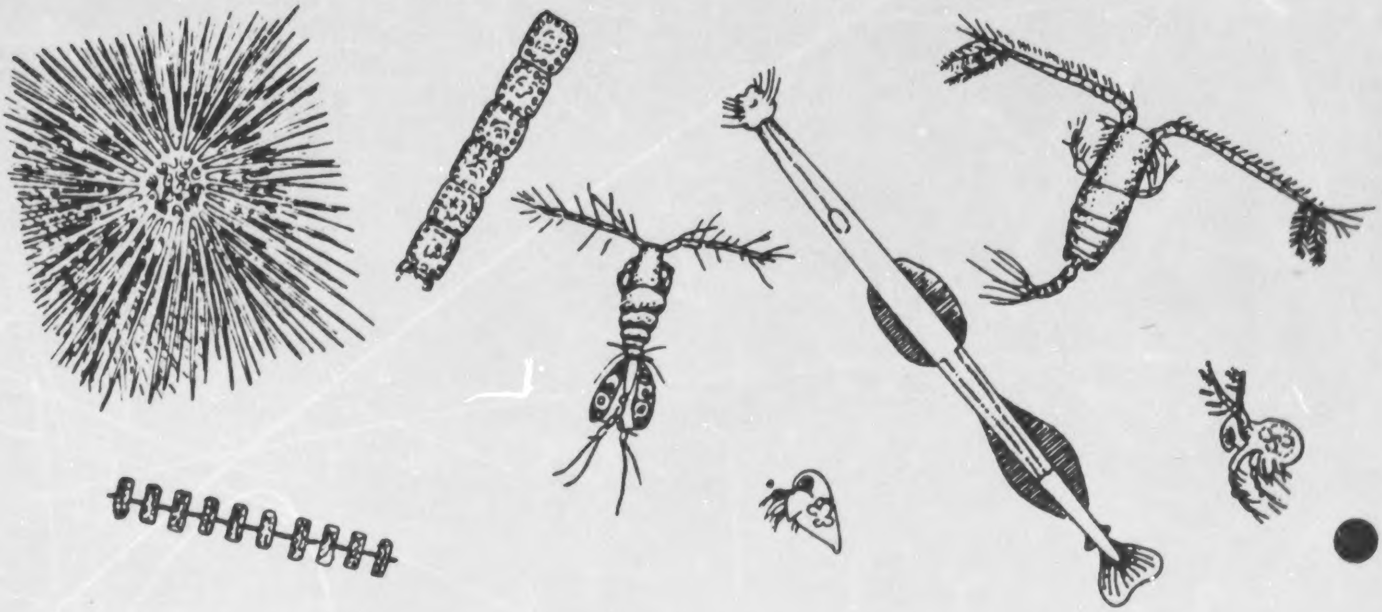
Barnacles

1. Barnacles sometimes live on

_________________________or___________________________________

Name ______________________ Page 2

Barnacles are like sea anemones. They grow in clusters. Barnacles eat very small plants and animals that drift in the water. These small plants and animals are called plankton.



Plankton as seen through a microscope.
Actual size 12 per inch (2 millimeters each).
|————| 12 plankton would fit on this line.

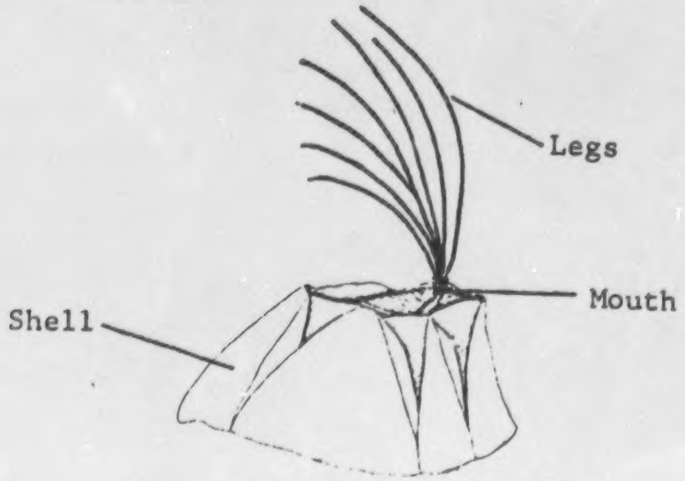
2. What do barnacles eat?

____

____

Name ______________________

Barnacles have feathery legs hidden inside their shells. The barnacle's feathery legs catch its food. The legs put the food into the barnacle's mouth.



Barnacle

Do you know how barnacles get oxygen out of the water? Barnacles breathe by gills. The gills are attached to their legs.

3. What other animals use gills for breathing? ______________

____

When the tide goes out, barnacles close their shell tightly. Some water stays inside. That way they do not dry out and can continue to take oxygen out of the water.

Sea stars eat barnacles. The sea stars can open the barnacle's tightly closed shell. Then it eats the barnacle. Sea stars keep us from being overrun by barnacles.

4. Why don't barnacles like sea stars?

____

____

TEACHER BACKGROUND - Have or Do?

"Have or Do?" is an activity designed to help students to learn to classify related facts. The ability to classify items is basic to science and to reading.

Duplicate the activity page. One copy per student is recommended. This exercise may be done individually or in small groups. It may also be started as an individual activity and concluded as a small group activity in which the groups confer and reach a concensus of opinion. Plan to devote a few minutes to discussion of the basic concepts covered. The "Key Words" should be taught if they are unfamiliar to your students.

You may need to provide some examples of the difference between "Have" and "Do". The activity essentially requires the students to distinguish between structures "Have" and behaviors "Do" . Provide the assistance necessary to get your class started on this activity.

KEY

LIST I.

3
5
6

LIST II.

1
2
4
7
8

KEY WORDS

attached
barnacles
clusters
feathery
gills
plankton
shells

Name ______________________________

HAVE OR DO?

Here is a list of things barnacles have and do. Each thing has a number in front of it. Separate the things barnacles have from the things barnacles do. Write the number of the things barnacles do in list 1. Write the number of the things barnacles have in list II.

1. Live on other animals
2. Eat plankton
3. Hard shells
4. Grow in clusters
5. Gills are attached to legs
6. Feathery legs
7. Catch food with legs
8. Grow on boats

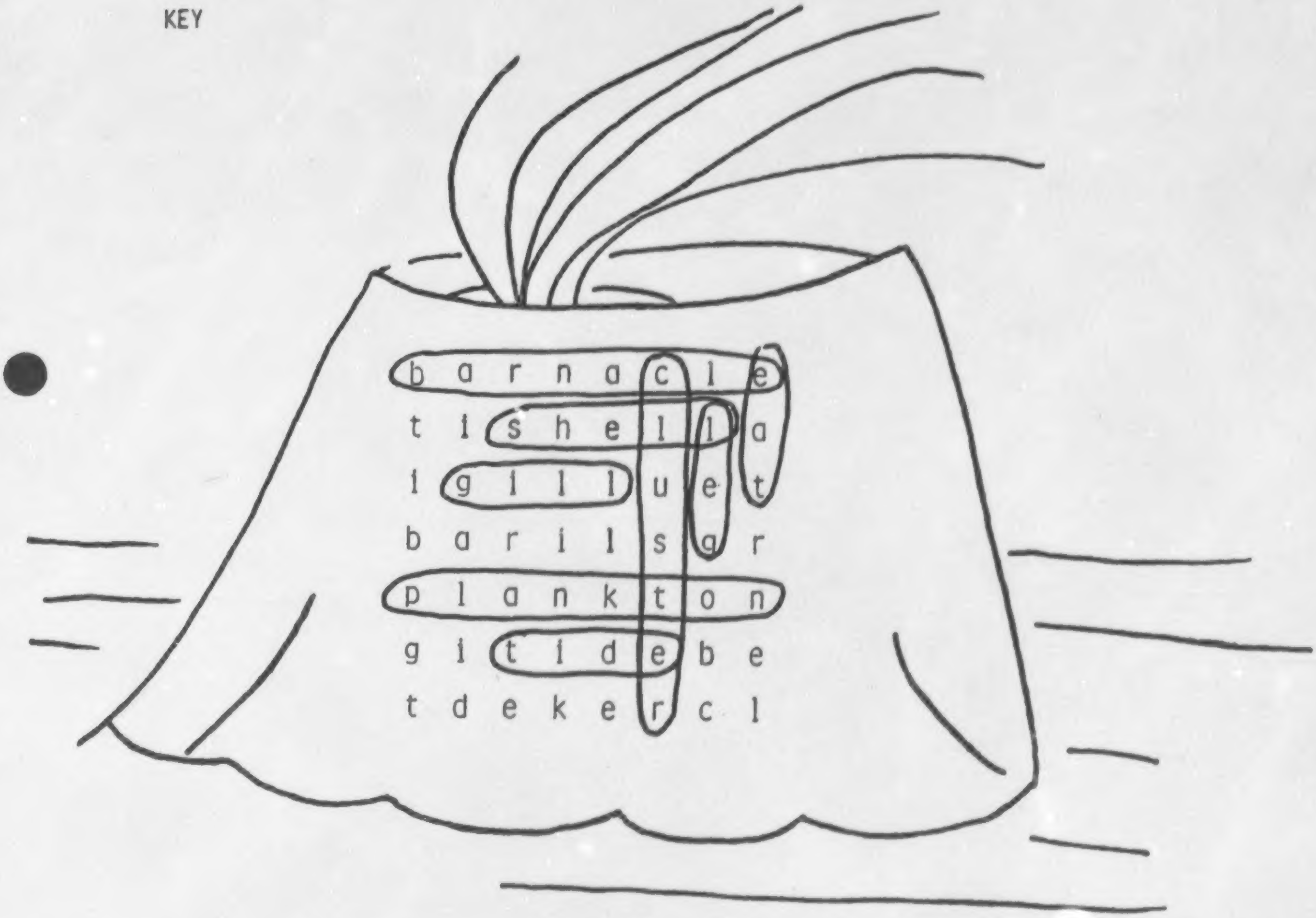
LIST I Things Barnacles Have	LIST II Things Barnacles Do.
____________	____________
____________	____________
____________	____________
____________	____________

TEACHER BACKGROUND - Missing Barnacles

"Missing Barnacles" is a word search game which helps build sight vocabulary and visual discrimination skills. Not all of your students may be familiar with this type of puzzle. Provide the assistance necessary to assure success for all of your students.

Duplicate the puzzle. One puzzle per student is recommended. This activity may be done individually. However, if your class is unfamiliar with this type of exercise, you might elect to have your students work in small groups. Plan to devote a few minutes of discussion to the basic concepts suggested by this activity. The "Key Words" used in the word search should be taught if they are unfamiliar.

KEY



b a r n a c l e
t i s h e l l a
i g i l l u e t
b a r i l s a r
p l a n k t o n
g i t i d e b e
t d e k e r c l

KEY WORDS- Key words are those circled above.

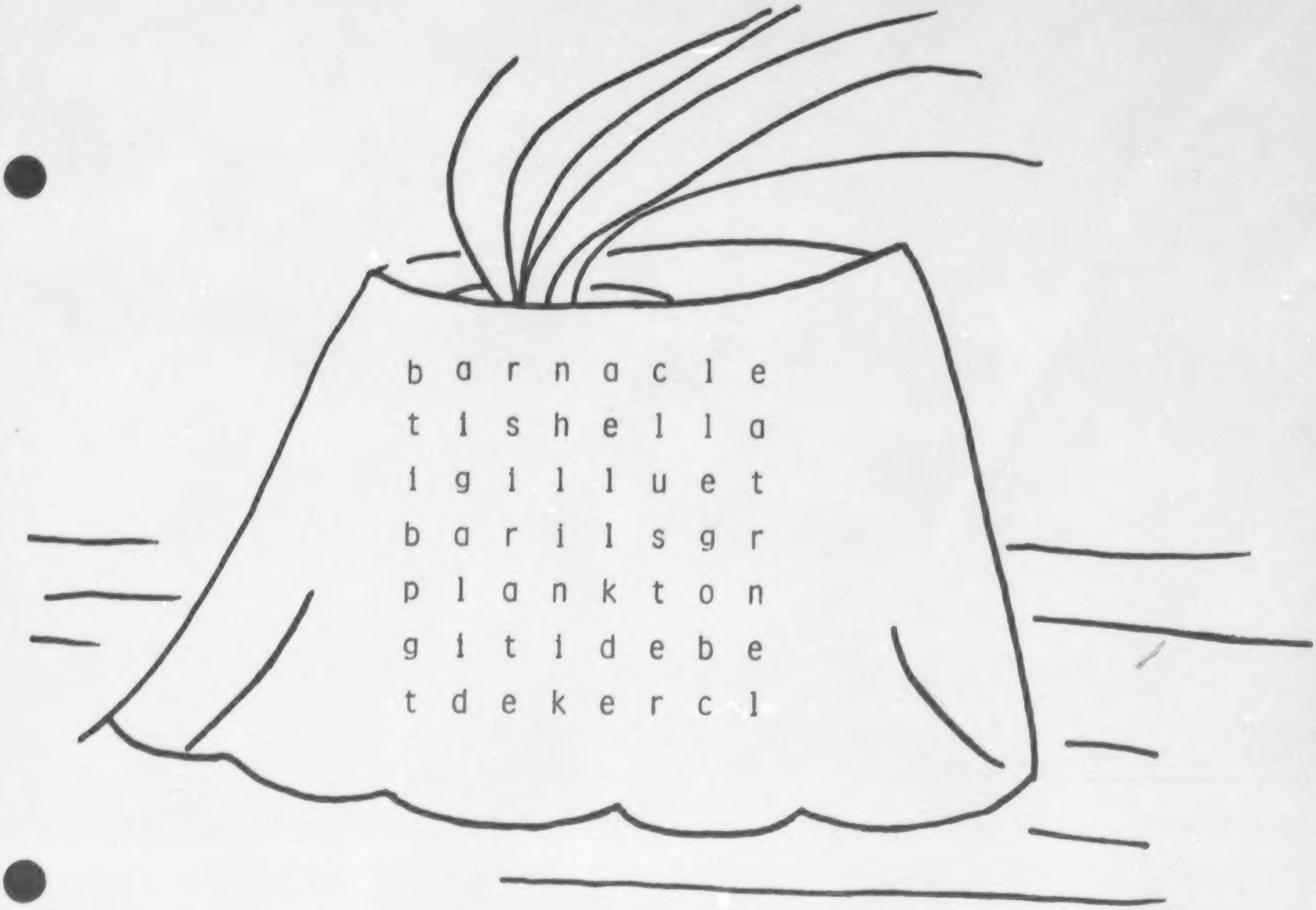
Name ______________________________

MISSING BARNACLES?

Can you find the missing words in our friend Barney Cull? The words are spelled left to right or up and down. Circle as many as you can find.

Words to look for:

barnacle
cluster
gills
eat
leg
plankton
tide
shell



b a r n a c l e
t i s h e l l a
i g i l l u e t
b a r i l s g r
p l a n k t o n
g i t i d e b e
t d e k e r c l

TEACHER BACKGROUND - Drying On The Line

Animals and plants that live in the intertidal zone face periods of immersion followed by periods of drying. These creatures have evolved numerous ways to avoid the hardships of their environment. Avoiding drying is a major problem for many of these organisms. Many adaptations exist to reduce drying during periods of exposure. Some animals trap water inside their shell, others close up shop and reduce the surface area exposed. Still others move or hide under rocks. "Drying on the Line" is a look at the effect of surface area on the rate of drying. The students will have a chance to see that marine animals can reduce their rate of drying simply by changing shape.

Duplicate the experiment pages. One set per student is recommended. Students may work alone, but pairs or small groups is preferred. Demonstrate the folding process. Have the students lightly wring out the two napkins. Caution students not to wet the books used as fulcrums. Devote some time to a discussion of the results and the way animals and plants can use the effects of reduced surface area to their advantage. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

5. The answers will probably vary. Have your students answer this question before they leave for lunch.
6. a. The ruler will tip toward the folded napkin side (it might tip to the point of falling) because of the drying of the flat napkin.
   b. The folded end will have more water.
   c. The flat napkin dried out more rapidly.
   d. The folded napkin had a shape most like a barnacle.
   e. Barnacles also keep wet by closing their opening when conditions begin to dry. Other answers are also possible, they could trap water inside, etc.

KEY WORDS

balance

barnacle

dry

evaporates

napkin

problem

tide

Name ______________________________

DRYING ON THE LINE

Barnacles have a problem. The tide goes out. They dry up. If they get too dry, they die. What is one thing they do to keep from drying? Let's look and see.

Here is what you will need:

Materials:

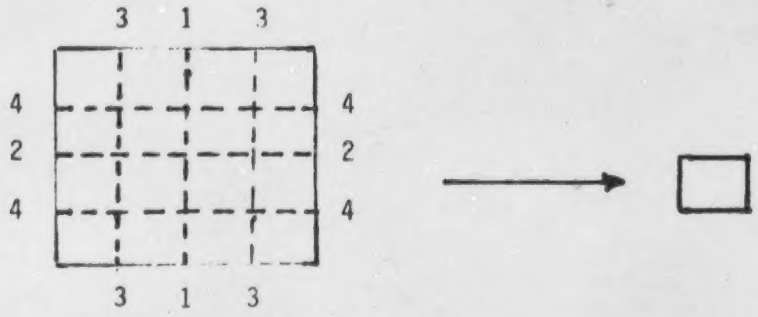
two paper napkins
ruler
book
water
clock

Here is what to do:

Procedure:

1. Take two paper napkins. The napkins must be the same size.

2. Fold one of the napkins in half four times.

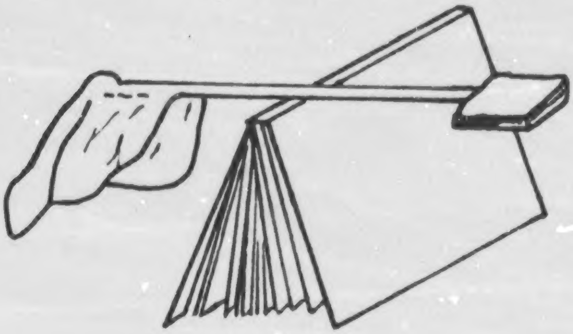


3. Do not fold the other napkin.

4. Wet both napkins with water. Which will dry faster? We can wait to see. Let's do something to save time.

Name ______________________

5. Do this at the beginning of lunch. Put the folded napkin on one end of the ruler. Put the other napkin on the other end. Balance the ruler on a book.



What do you think will happen? ______________________

6. Go have lunch (or wait an hour).

a. What happened? ______________________

b. Which end has more water? ______________________

c. Which napkin dried out faster? ______________________

Barnacles don't want to dry out. Their shape helps keep them wet.

d. Which napkin had a shape most like a barnacle? ____________
____
____

e. How else might barnacles keep wet? ______________________
____
____

Flat napkins and flat animals dry out faster. The water evaporates into the air. The flat napkins and flat animals have more air around them. They lose more water into the air because they have more air around them.

SEA STARS

TEACHER BACKGROUND - Sea Stars

"Sea Stars" investigates a common inhabitant of the intertidal zone. Although sea stars (starfish) are more familiar to students than many of the other marine organisms, be sure to provide pictures and visual aids to help your students visualize the animals.

Sea Stars are interesting creatures of the sea which have several unusual characteristics. With their hundreds of tiny tube feet they can move in any direction, crawling along the bottom of the sea or up a piling. These feet are so strong and powerful that when they all work together they can literally pull an oyster or clam apart.

Because oysters and clams are the bulk of the Sea star's diet, sea stars have become very unpopular with the oyster growers, and at one time were cut up into many pieces in an attempt to eliminate them. Much to the surprise of the oyster growers, this only made the matter worse because each part became a whole new sea star through the process of regeneration. The sea star is an eager eater. After waiting and pulling for hours in order to get an oyster open, it doesn't bother to chew it. The sea star eats the oyster by enveloping its stomach around the food. The sea star has gills, however its gills are not used for breathing. Instead, starfish breathe through their top surface covering.

If you have a sea star in your aquarium, it may be interesting for the students to try to observe if the sea star has a front or back by observing which side or ray of the sea star is most often in the front when he is traveling.

The book entitled Starfish by Marjorie Furlong has excellent color pictures of many different species of sea star and includes considerable information on how to preserve them for a collection. Collecting of marine specimens is generally not recommended. The philosophy of "Take Only Memories, Leave Only Footprints" should prevail on your field trips.

Duplicate the text pages. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. The Key Words should be taught if they are unfamilar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

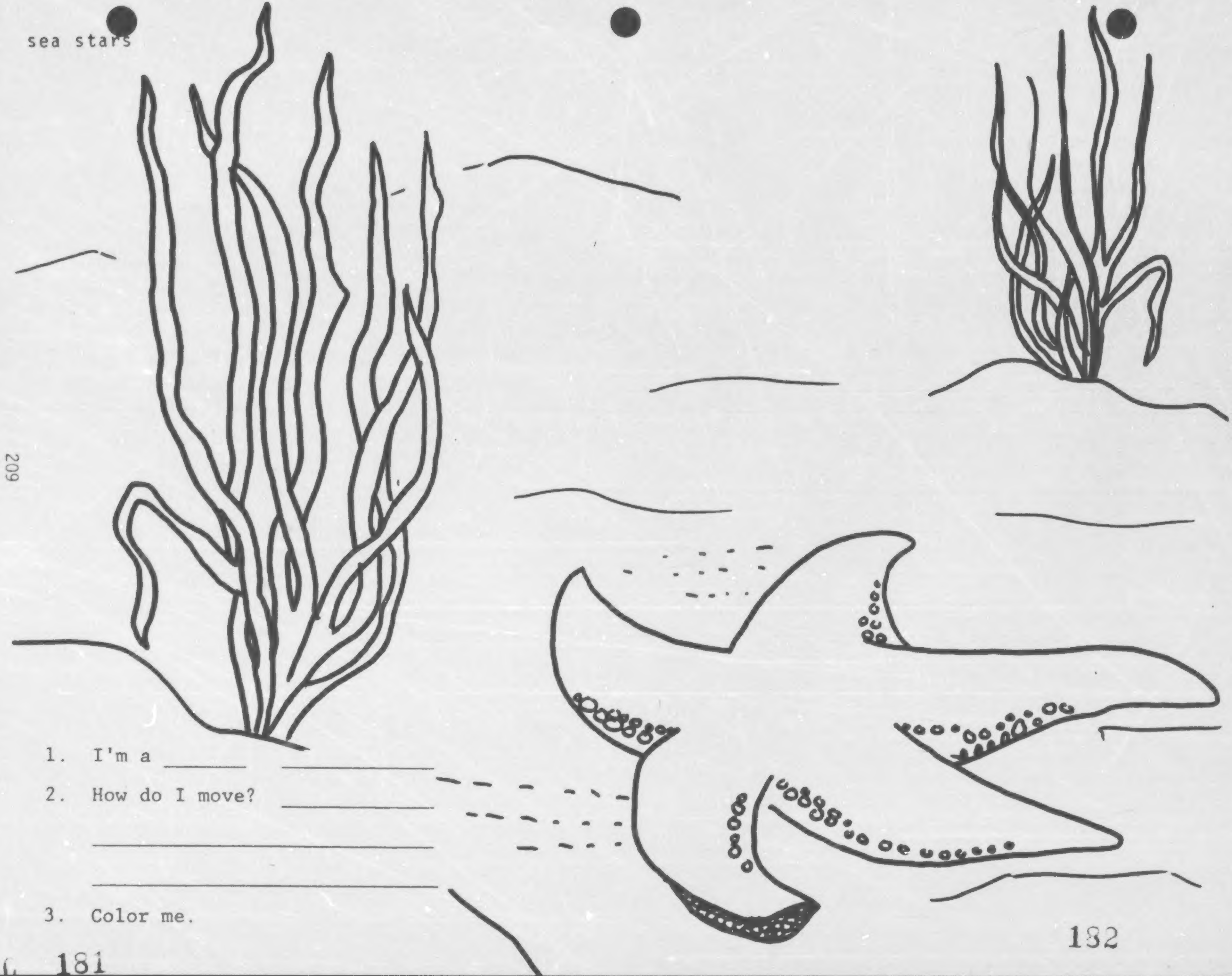
KEY - Text questions

1. Unfortunately people cannot grow back missing arms like the starfish. This is a good opportunity to discuss the remarkable adaptation of regeneration If man could learn how to turn the cells of growth on and off like the sea star, perhaps we could replace lost or diseased organs at will. Regeneration is, however, a slow process and often times an animal missing one of its appendages will succumb to predation or starvation before regeneration is complete. Students should be discouraged from conducting their own regeneration experiments.
2. Short spines cover the top side of a sea star.
3. The sea star uses its tube feet to open clams or oysters, to fasten itself to rocks and pilings, and to move.
4. The sea star pulls the clam open, then moves its stomach into the opened shell.
5. Sea star eggs drift in the water after they are laid.

KEY WORDS

clams
drift
eggs
life cycle
mouth
mussels
oysters
rays
sea star
settle
spines
stomach
tube feet
underside

sea stars



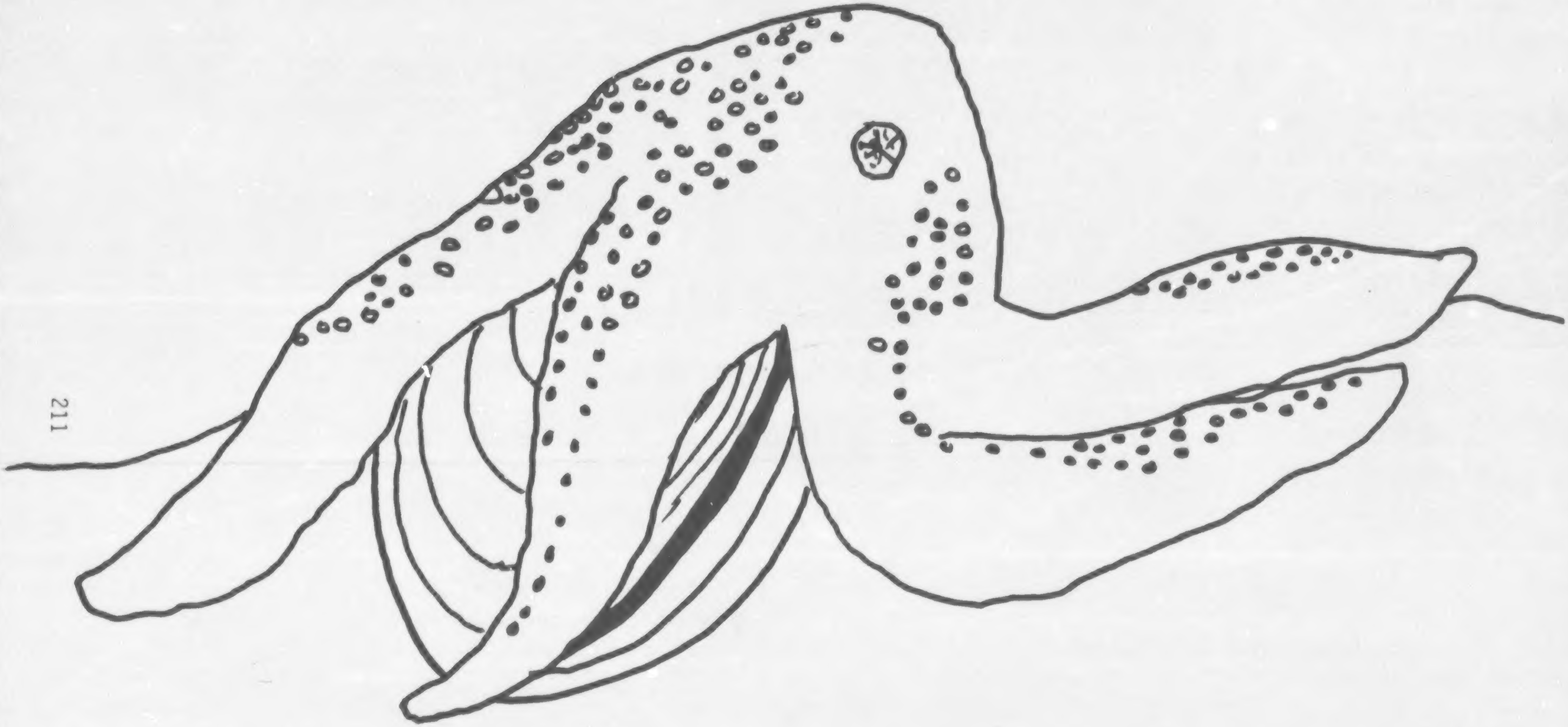
1. I'm a ________ ______________

2. How do I move? ______________

____

____

3. Color me.



Clams for dinner!

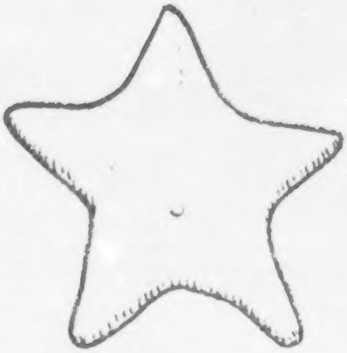
1. I am a ________ ____________.

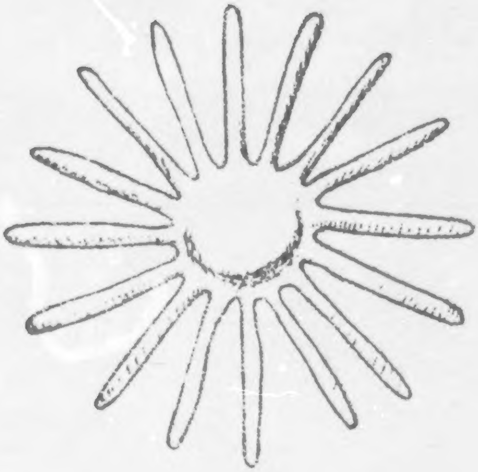
2. What am I doing? ____

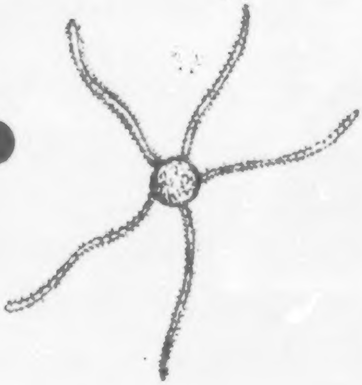
3. Color us.

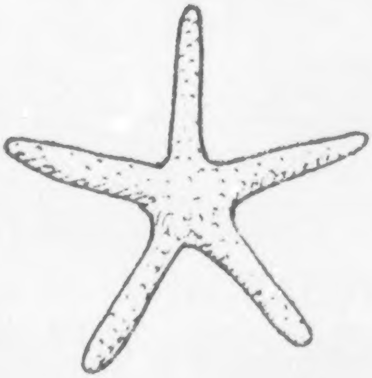
overhead

Sea stars, sometimes called "starfish," have many different shapes.







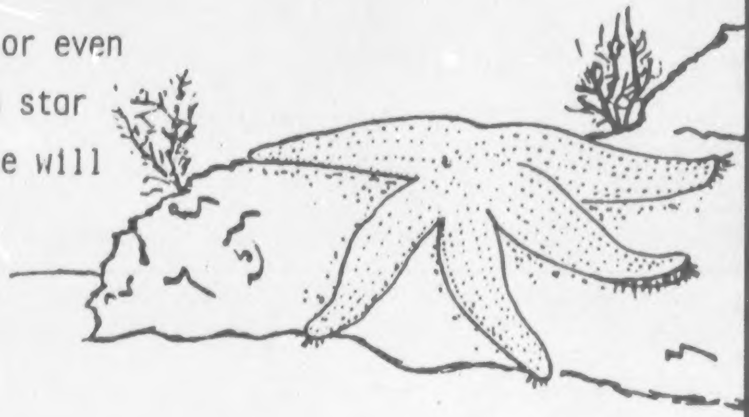


Brittle stars have very thin, flexible arms. Which one of these sea stars is a brittle star?

Name ____________________

THE SEA STAR

Sea stars come in many colors. They are flat and have arms. We call their arms rays. They may have five, six, ten or even twenty rays. Sometimes a sea star will lose a ray, but a new one will grow back slowly.



A sea star on a rock

1. Can people grow back missing arms? ____________________

____

The top side of the sea star is very hard. There are short spines on it. The sea star breathes through this top covering.

2. What covers the top side of a sea star?

____

Name ______________________________ Page 2

The underside of a sea star has many tube feet. The tube feet fasten the sea star to clams, oysters, rocks or pilings. The sea star uses its tube feet to move. A sea star can pull open a clam or oyster with its tube feet.

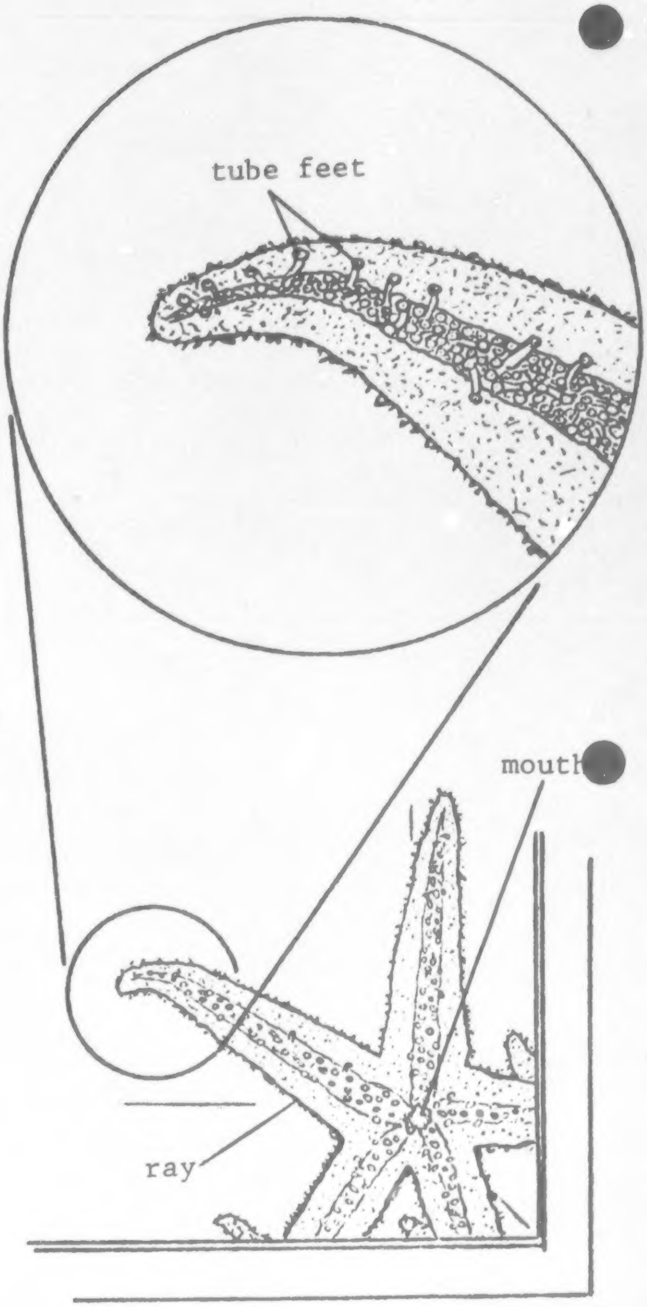
3. A sea star uses its tube feet to:

a. ______________________________

____

b. ______________________________

____

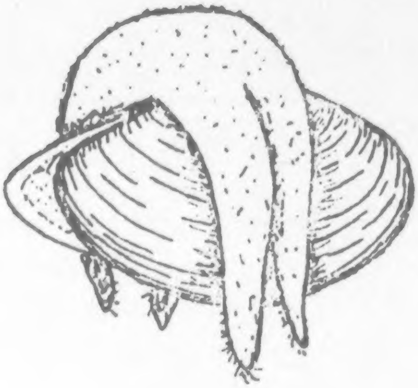


The underside of a sea star.

157

Name ______________________________ Page 3

The sea star has a mouth on its underside. It eats clams, oysters, and mussels. The tube feet pull the shellfish open. The sea star's stomach comes out of its body. The sea star pushes its stomach into the opened shell. It then eats the oyster, clam or mussel.



Sea star opening a clam.

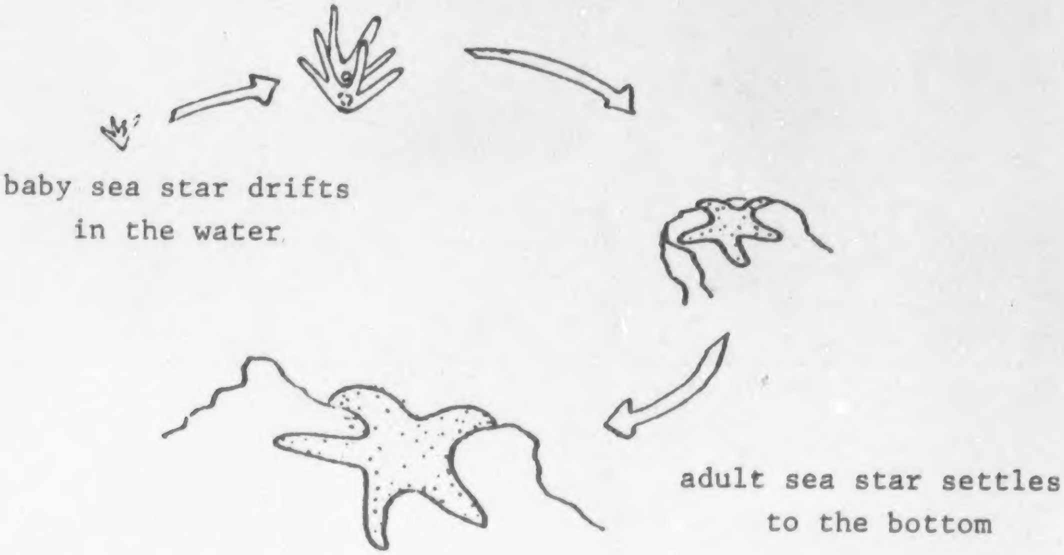
4. How does a sea star eat a clam? ________________________________

____

____

Name ______________________________

Mother Sea Star lays her eggs in the water. While they are growing into sea stars they drift around in the water. When they have grown large enough they will settle to the bottom.


baby sea star drifts
in the water
adult sea star settles
to the bottom

Life Cycle

5. What do sea star eggs do after they are laid? ______________

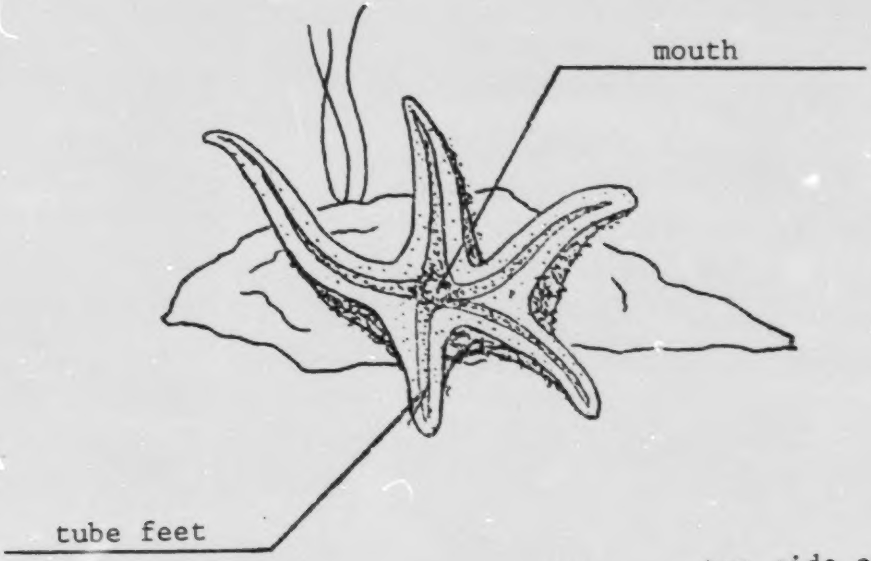
____

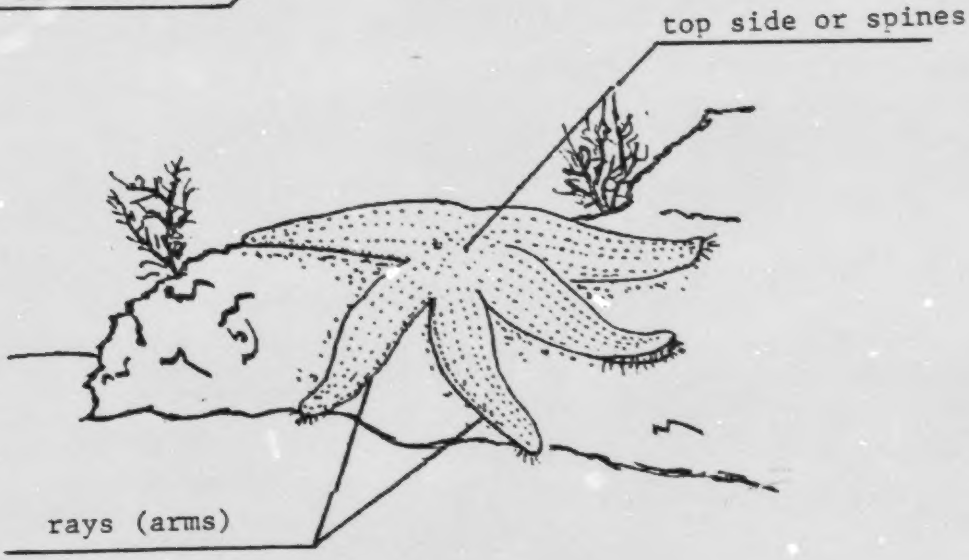
TEACHER BACKGROUND - Sea Star

This activity is designed to increase student familiarity with the body plan of the sea star. The sea stars shown are different from those in the previous text section. But your students should have little difficulty in making the transfer from one to the other.

Duplicate the "Sea Star" activity page. One copy per student is recommended. Students may work independently. Plan to allow a few minutes for discussion after your class has labeled the parts. Emphasize the function of each of the parts labeled. The "Key Words" should be taught if they are unfamiliar to your students. You may want to have your class color the drawings after they are labeled.

KEY





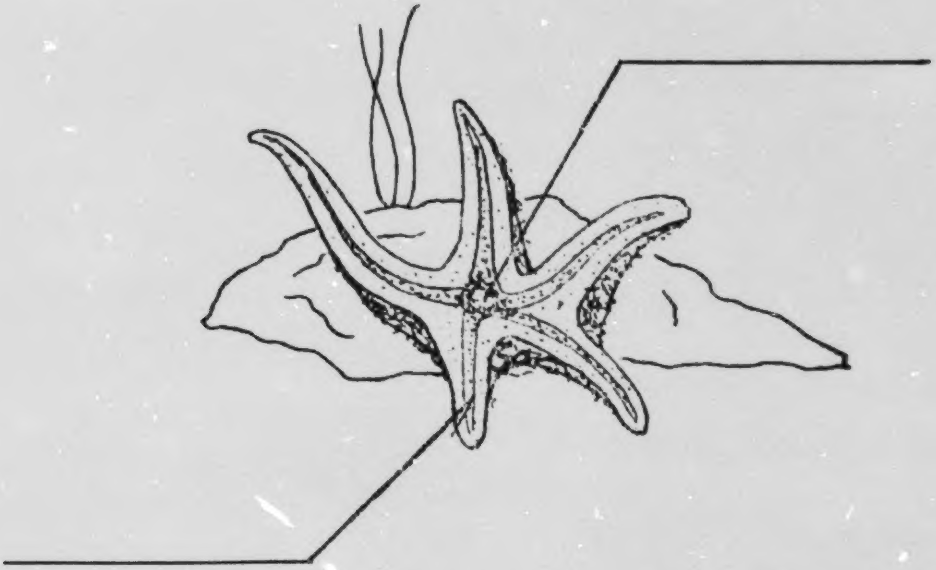
KEY WORDS

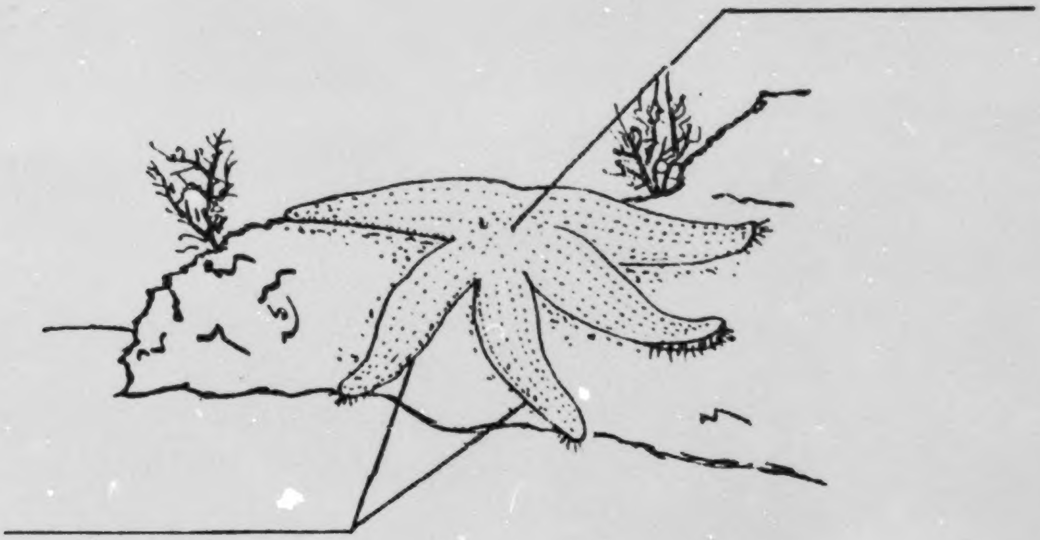
mouth
rays
spines
tube feet

Name ______________________________

SEA STAR

Label the parts of this marine animal.





TEACHER BACKGROUND - What's Happening?

"What's Happening?" is directed writing. This writing exercise is designed to fulfull two educational purposes:

1. It contributes to the child's development of his powers of awareness, observation and sensitivity.

2. It contributes to the child's ability to communicate in an interesting and effective manner.

Duplicate "What's Happening?" One copy per student is recommended. Allow the students ample time to complete the writing assignment. Help them with vocabulary etc. about which they ask, but avoid suggesting topics as much as possible. Upon completion, volunteers can read their stories to the class. Be sure to display these stories where all can enjoy them.

KEY - questions

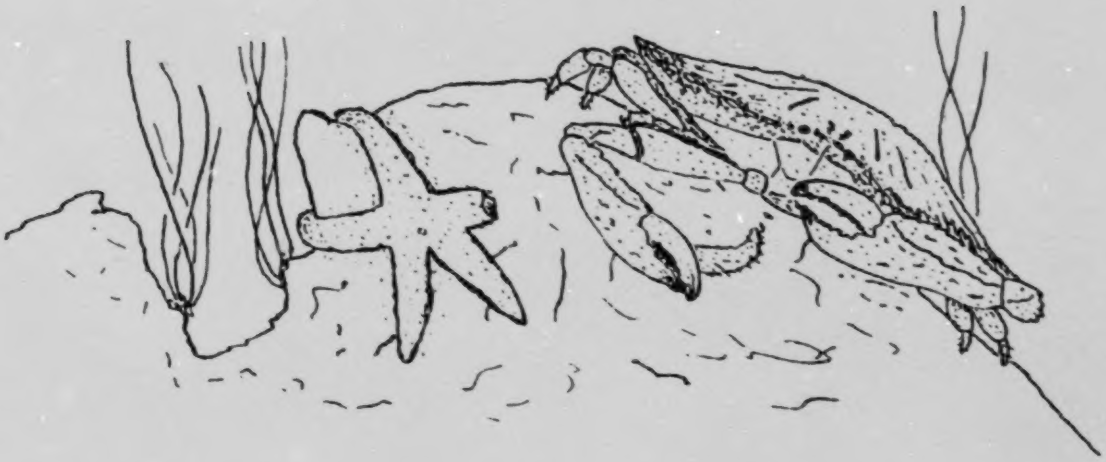
1. The animals are a sea star and a crab.

2. The smallest animal, the sea star, has just had a ray pinched off.

3. The sea star will eventually regenerate a new ray.

Name ______________________________

WHAT'S HAPPENING?



Make a story describing this picture.

In your story tell:

1. What are these two animals?
2. What is happening to the smallest animal?
3. What will the smallest animal do now?

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TEACHER BACKGROUND - Sea Star Matching

This activity reinforces topics covered in the text. The correct answers are all available through careful reading. Duplicate the "Sea Star Matching" page. Provide enough direction to get your class started. This type of exercise should be familar. If it is not, be sure to check that students are progressing successfully after you start them on their own. Plan to devote a few minutes to a discussion of the concepts suggested by this activity. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

1. Sea stars eat clams (Not children).
2. Sea star arms are called rays.
3. Sea stars use tube feet to move.
4. Sea stars can make their stomach come out of their body.
5. Baby sea stars drift in the water.
6. The brittle star is on the right.

KEY WORDS

bottom
brittle
children
clams
drift
eggs
rays
stomach
tube feet

Name ______________________________

SEA STAR MATCHING

Words

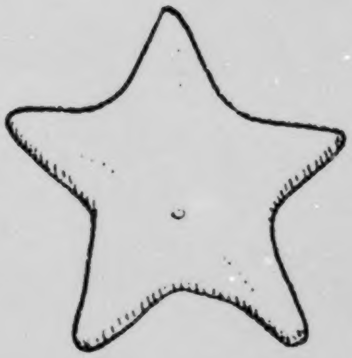
- bottom
- children
- tube feet
- eggs
- clams
- rays
- drift
- stomach

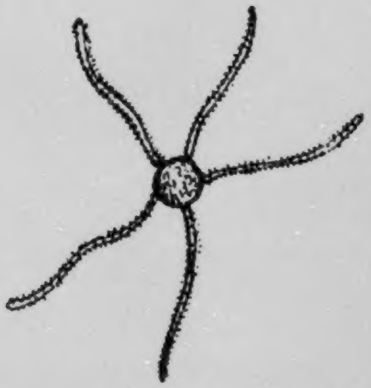
Fill in the blanks.

Use the words in the list to fill in the blanks.

Be sure your answers make sense.

1. Sea stars eat _______________.
2. Sea star arms are called _______________.
3. Sea stars use _______________ _______________ to move.
4. Sea stars can make their _______________come out of their body.
5. Baby sea stars _______________ in the water.
6. Brittle stars have very thin, flexible arms. Circle the brittle star.





TEACHER BACKGROUND - Sea Views

This activity is designed to increase the student's familiarity with marine life. Provide books and magazines for pictures of marine plants and animals. Encourage your students to model their objects after real-life organisms. You can facilitate understanding of the relationships that exist in the ocean by encouraging your students to make sea views that show interrelationships.

Duplicate the directions. One copy per student is recommended. Provide the assistance necessary for understanding. The "Key Words" should be taught if they are unfamiliar to your students.

Be careful in using the iron. Be sure that the paper does not become too hot. Aside from the danger of fire, the wax dissapates and does not make a good seal. Be aware of the hot iron at all times and caution your students not to touch the hot items.

You can encourage enthusiasm in the classroom by displaying the finished products.

You can engineer interest in the community by sending the finished products home.

KEY WORDS

grated

scene

sprinkle

Name ______________________________ Page 1

SEA VIEWS

Here is your chance to make a special picture of ocean life. To make your ocean scene you will need the following:

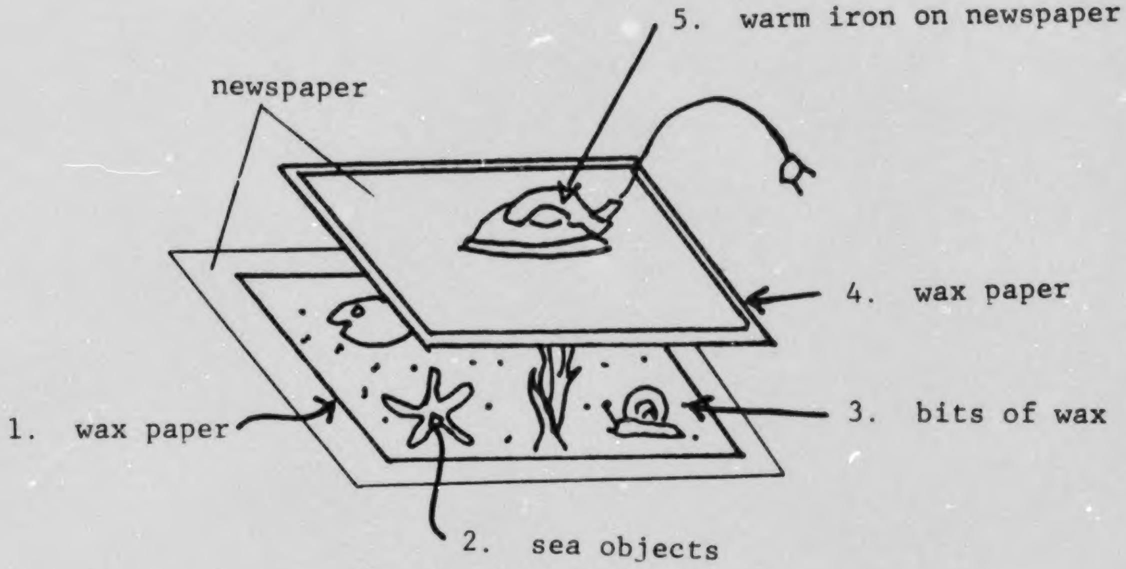
Materials:

wax paper
grated or shaved paraffin or crayons
construction paper
scrap art materials
iron
newspaper

Here is how to do it:

Procedure:

1. Use the construction paper and art materials to make a sea objects picture.
2. Place your objects on a piece of wax paper. Arrange the objects into a sea scene.
3. Sprinkle bits of wax or crayon over your scene. This will help the objects stick to the wax paper.
4. Place another piece of wax paper on top.
5. Put all of this between pieces of newspaper. Press with a warm iron.


5. warm iron on newspaper
newspaper
4. wax paper
3. bits of wax
1. wax paper
2. sea objects

6. Trim the edges of the pieces of wax paper.

7. Display and enjoy your scene.

13.)

CRABS

TEACHER BACKGROUND - Crabs

Crabs are a common seashore inhabitatant with some uncommon qualities. This section provides the student with a chance to discover some of these qualities. Supplement the activities with live or frozen crabs as well as pictures of crabs.

Of all the marine animals, children seem to be most excited about crabs. Maybe this is due to the fact that crabs are easily accessible and that they offer a challenge to the student in avoiding those tricky pinchers. Crabs have a way of providing action as well as reaction. A crab's pinchers are unique, not only in being able to regenerate if broken off, but in their mobility when being used to feed the crab.

The students may discover movement characteristics of the crab by placing the crab in a dry container and encouraging it to move forward or backward. The walk of a crab provides a good topic for creative dramatics in which the students conduct body movements to show the crab's actions during its sideways walk.

The crab is an unique animal in many ways. It grows from the inside out, producing a new and larger shell inside an old and smaller one. This is accomplished by making the new shell flexible and inflatable to begin with. When ready, the crab just slips over the back door of his old shell and, behold, he has a new and larger shell in its place. The shell is a little soft to begin with, but it will soon harden into a strong protective armor.

The crab is also unique in its ability to survive out of water for short periods of time. This is possible because the crab is able to trap water in its gills, (which it uses to obtain oxygen).

Small shore crabs play a vital role in keeping our beaches clean of refuse and decaying debris. Students should be aware of the detrimental affects resulting from their collection of these small creatures in quantities.

Duplicate the text pages. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. The Key Words should be taught if they are unfamilar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

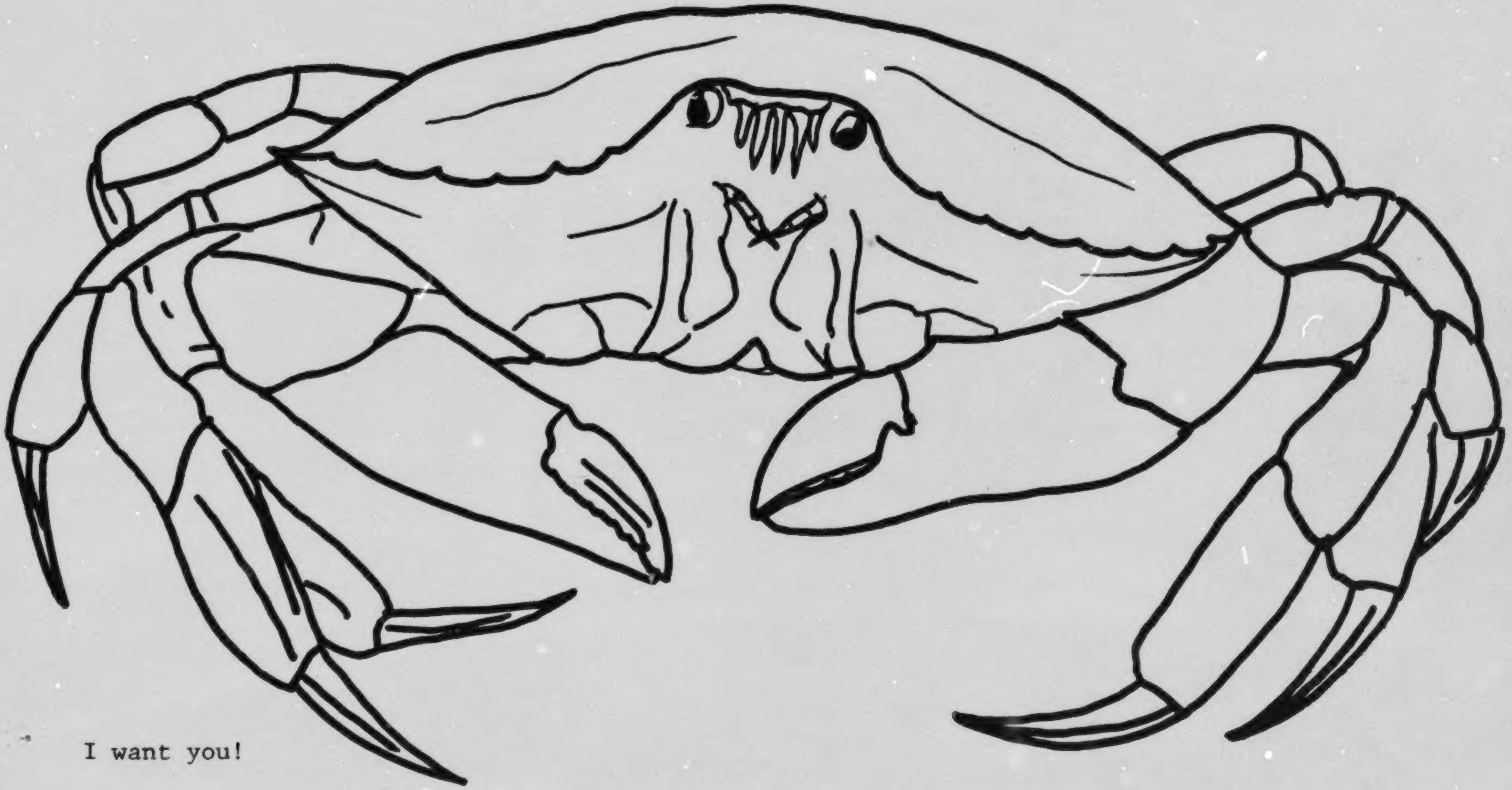
The role of the crab in seashore life can be explored through creative writing using topics such as: "If I were a Crab" or "What I did As 'Crab For A Day'".

KEY - Text questions

1. Crabs grow by crawling out of their old shell (molting).
2. Scavengers eat old and dead sea animals and plants.
3. Most crabs have eight legs.
4. We see behind us by moving our head or our body. Crabs eyes allow vision behind as well as ahead.

KEY WORDS

eggs
molting
pinchers
porcelain
scavenger
sideways
stem
stomach



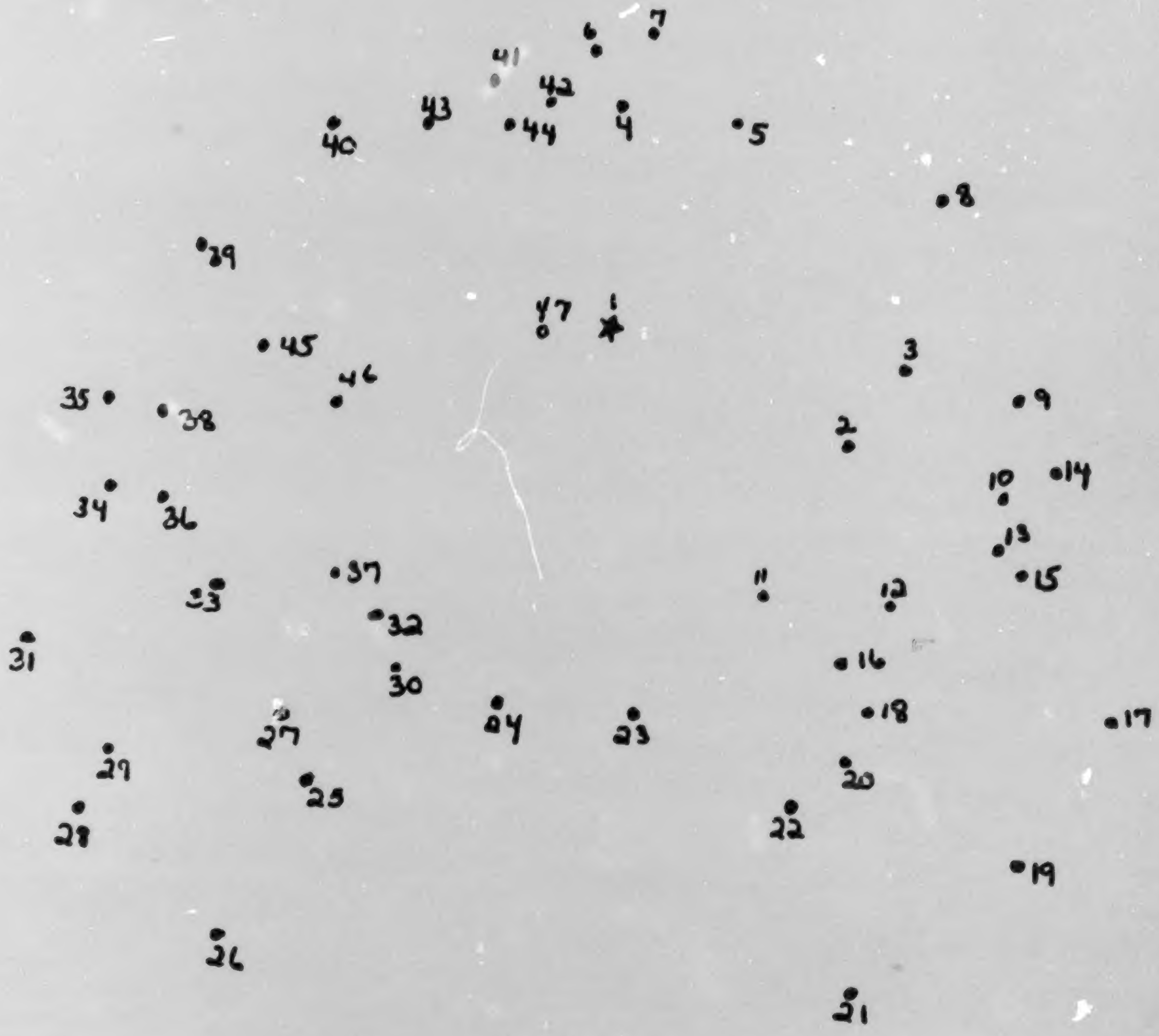
I want you!

1. I'm a ____________________.

2. Give me a name. "Hi! My name is ________________________."

3. Count my pinchers. I have ____________________ pinchers.

4. Color me.

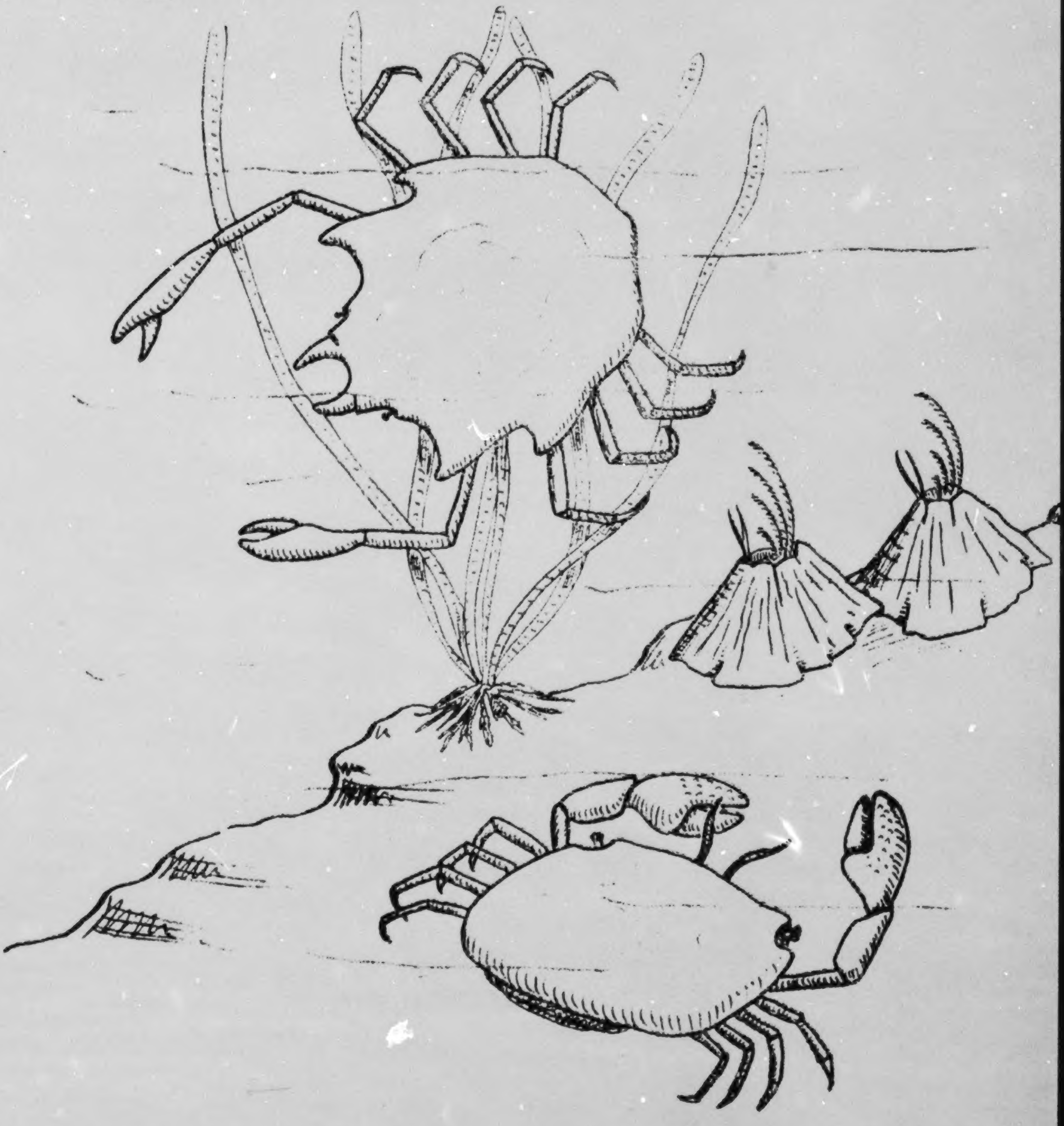

7
6
41
42
43
44
4
5
40
8
39
47
1
3
45
46
35
38
9
2
10
14
34
36
13
37
15
11
12
33
32
31
16
30
18
17
24
23
27
29
20
25
22
28
19
26
21

Sometimes I can be very nasty when people want to go swimming.
I make a good meal.

Do you know what I am? I am a ______________________.

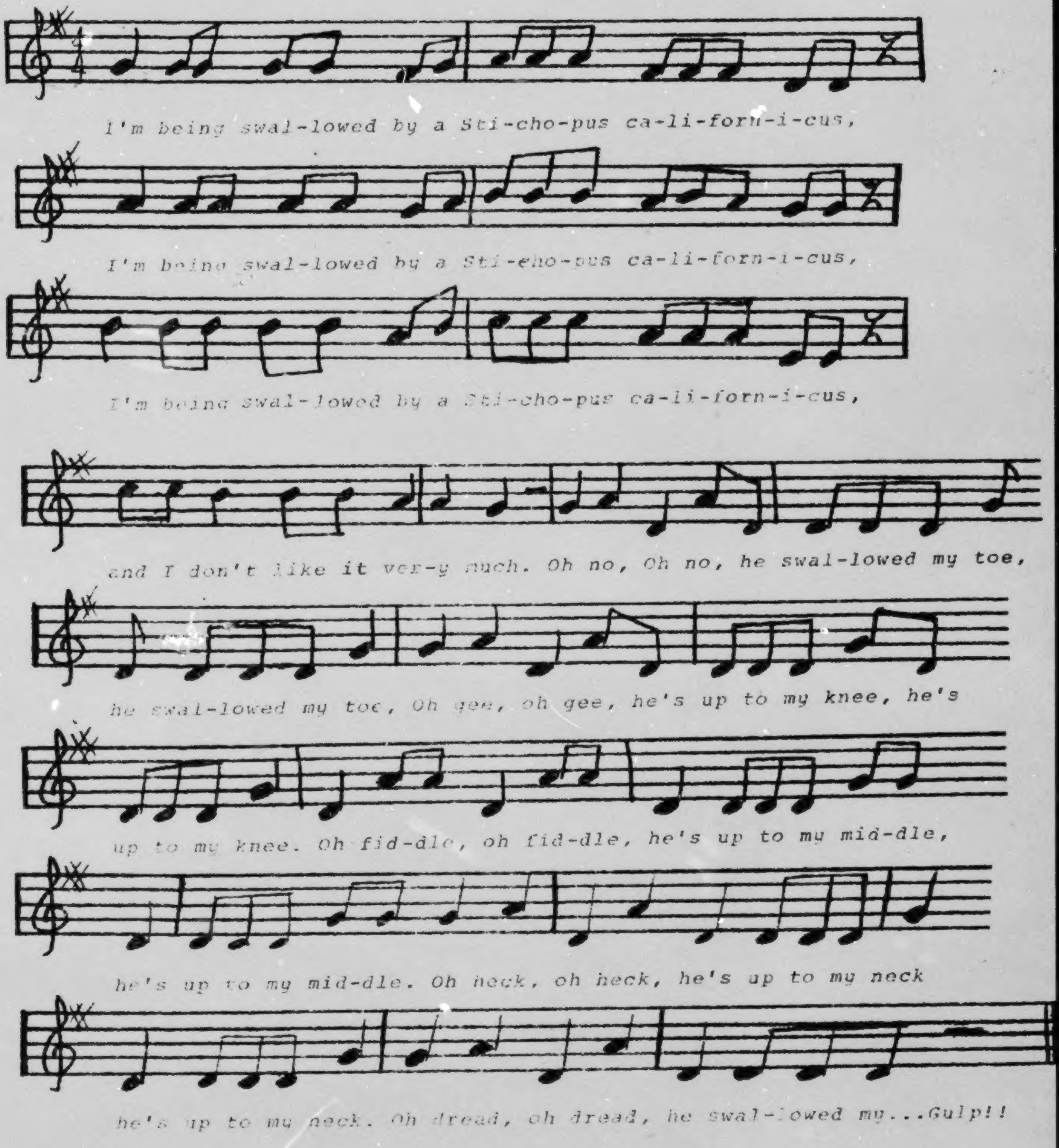
* From the Wetlands Institute
Cape May Co., New Jersey

overhead



Among the rocks
you will see crabs and
barnacles. Are these related?

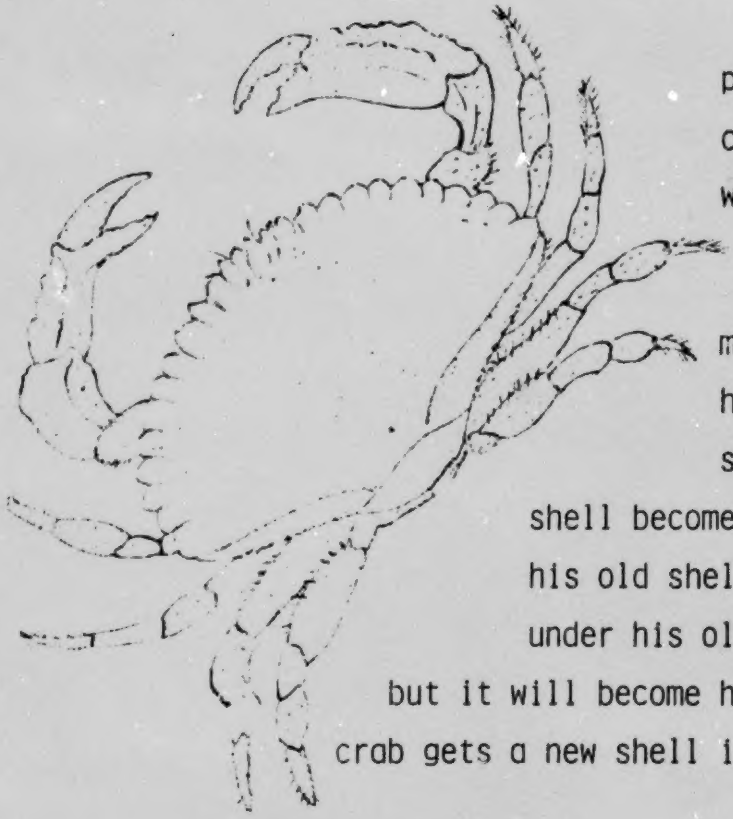
I'M BEING SWALLOWED


I'm being swal-lowed by a Sti-cho-pus ca-li-forn-i-cus,
I'm being swal-lowed by a Sti-cho-pus ca-li-forn-i-cus,
I'm being swal-lowed by a Sti-cho-pus ca-li-forn-i-cus,
and I don't like it ver-y much. Oh no, Oh no, he swal-lowed my toe,
he swal-lowed my toe, Oh gee, oh gee, he's up to my knee, he's
up to my knee. Oh fid-dle, oh fid-dle, he's up to my mid-dle,
he's up to my mid-dle. Oh heck, oh heck, he's up to my neck
he's up to my neck. Oh dread, oh dread, he swal-lowed my...Gulp!!

[*] Stichopus californicus is the large, red sea cucumber.

Name ______________________________ Page 1

CRABS



Crabs are green, red, yellow, purple or almost any color. They can be very tiny or several feet wide.

Crabs hatch from eggs. The mother crab carries the eggs on her stomach. Crabs grow but their shells do not. When a crab's shell becomes too tight, he crawls out of his old shell. He has grown a new shell under his old shell. The new shell is soft but it will become hard like the old shell. When a crab gets a new shell it is called molting.

1. Does a crab's shell grow? ______________________________

____

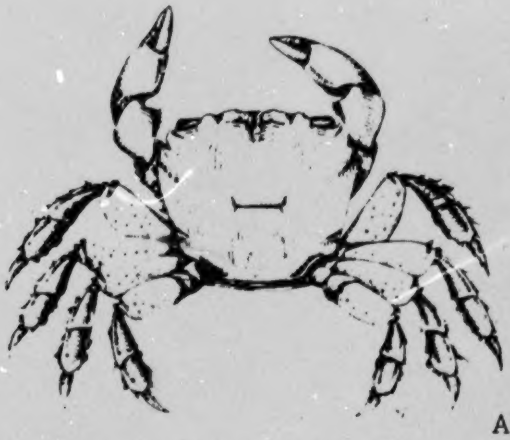
A crab is a scavenger. Scavenger means a garbage collector. Like a garbage collector, he helps to keep our beaches clean. Crabs eat old and dead sea animals. They eat small living sea animals too.

2. What does a scavenger eat? ______________________________

____

____

Name ______________________ Page 2


About life - size

Shore Crab

Crabs usually have eight legs and two big pinchers. The pinchers are used to tear food. They tear the food into small enough pieces to eat.

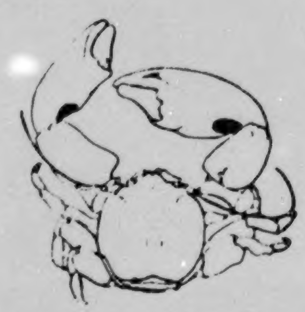
Sometimes a crab may lose a leg or a pincher. In time, a new one will grow back.

3. How many legs do most crabs have? ______________________

____

A crab usually walks sideways. The crab has two eyes which are on stems. A crab can see what is behind him.

Porcelain Crab


½ inch wide or
1.25 centimeters

4. How do we see what is behind us? ______________________

______________________ ______________________

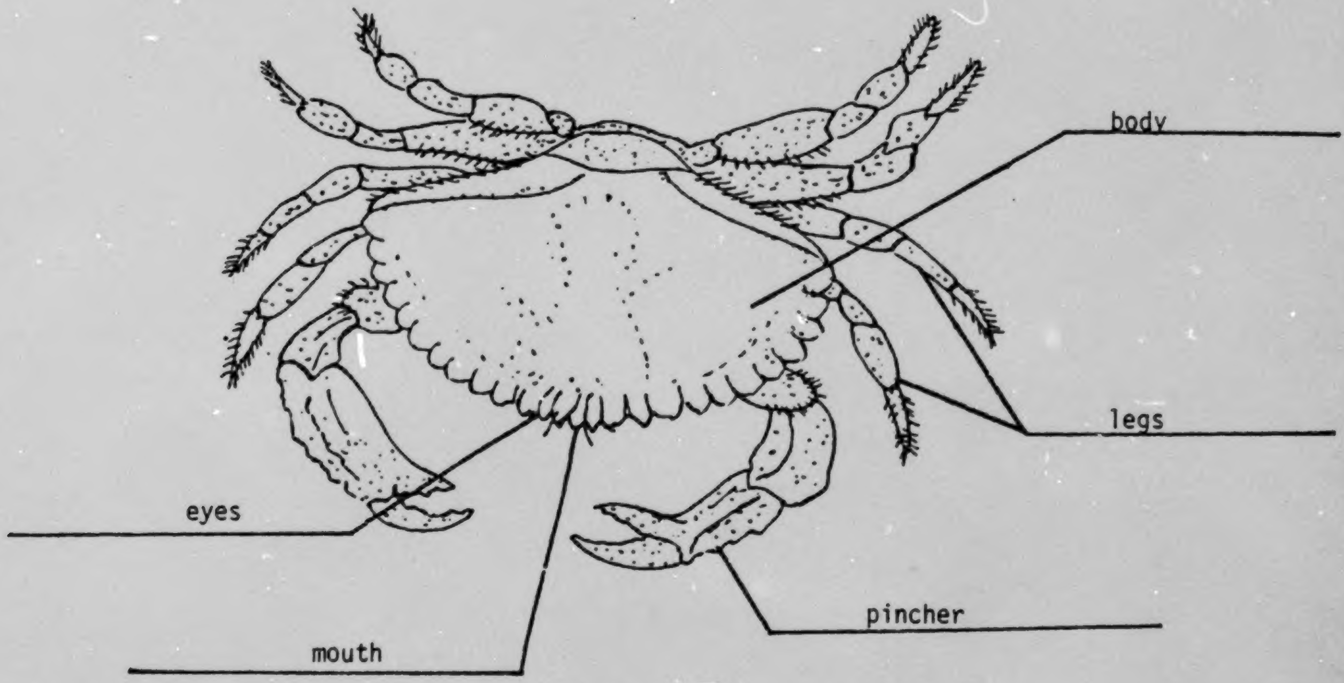
TEACHER BACKGROUND - Name That Part!

This exercise is similar to several that have gone before. The student will need to find the part names from the text rather than from labeled drawings as in the previous activities.

Duplicate the "Name That Part" page. One copy per student is recommended. This activity may be performed independently or in small groups. Choose the method that works best with your class.

Plan to spend a few minutes discussing the correct labels and the basic concepts suggested by the activity. Relate structure to function in the crab as you discuss the answers. The "Key Words" should be taught if they are unfamiliar to your students. You may have your students add a background and color the labeled crab.

KEY



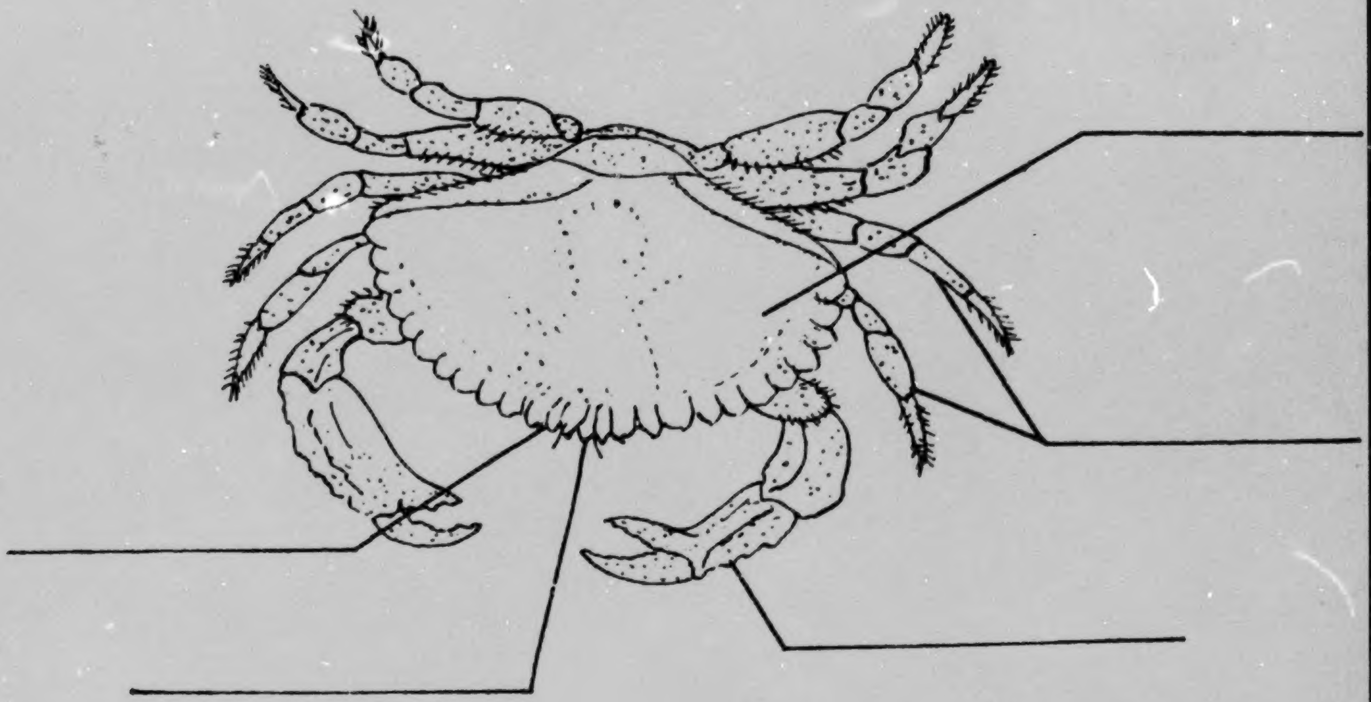
KEY WORDS

The key words are the names of the body parts reinforced by this activity.

210

Name ______________________________

NAME THAT PART!



Name my parts using these words:

eyes	mouth
body	legs
pincher	

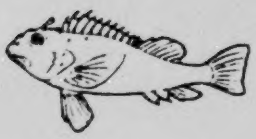
TEACHER BACKGROUND - Groupings

"GROUPINGS" is a classification activity. Sorting objects into groups is a basic activity in both science and reading. The groups are provided in this activity. Encourage the students to find other characteristics that can be used to distinguish between the individual organisms shown.

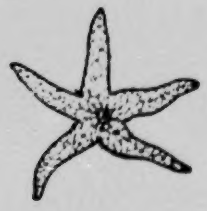
Duplicate the "GROUPINGS" page. One copy per student is recommended. The students may work individually or in small groups at your discretion. Plan to discuss classification in general when you discuss the correct answers. Ask your students what other characteristics we could use to distinguish between the organisms shown. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

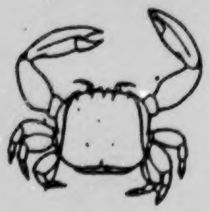
1.



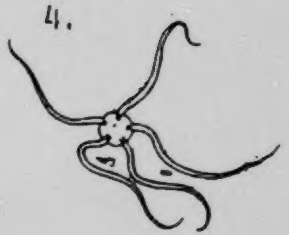
2.



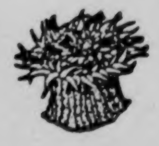
3.



4.



5.



Legs	No Legs
2,3,4,5	1,5

Eyes	No Eyes
1,3	2,4,5

More than five legs	Five or less legs
3	1, 2, 4, 5,

soft surface covering	Hard surface covering
1, 5	2, 3, 4

Notice that there is a difference between the first three pairs of characteristics and the fourth. The fourth characteristic "soft" vs. "hard" is subjective. How "soft" is "soft"? This type of characteristic is a poor one to use to discriminate between items because not everyone can agree on definitions. Everyone can agree on the presence or absence of eyes which is an objective characteristic.

You might try exploring this concept with your class.

KEY WORDS

covering

eyes

legs

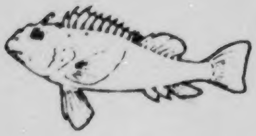
surface

Name ______________________________

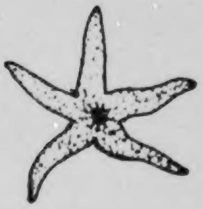
GROUPINGS

Look at the pictures. Each picture has a number. Put the number under the correct groups below.

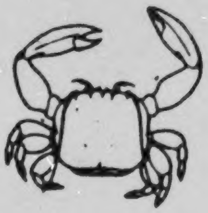
1.



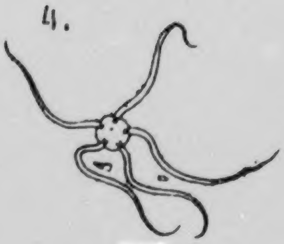
2.



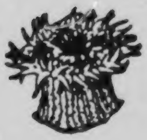
3.



4.



5.



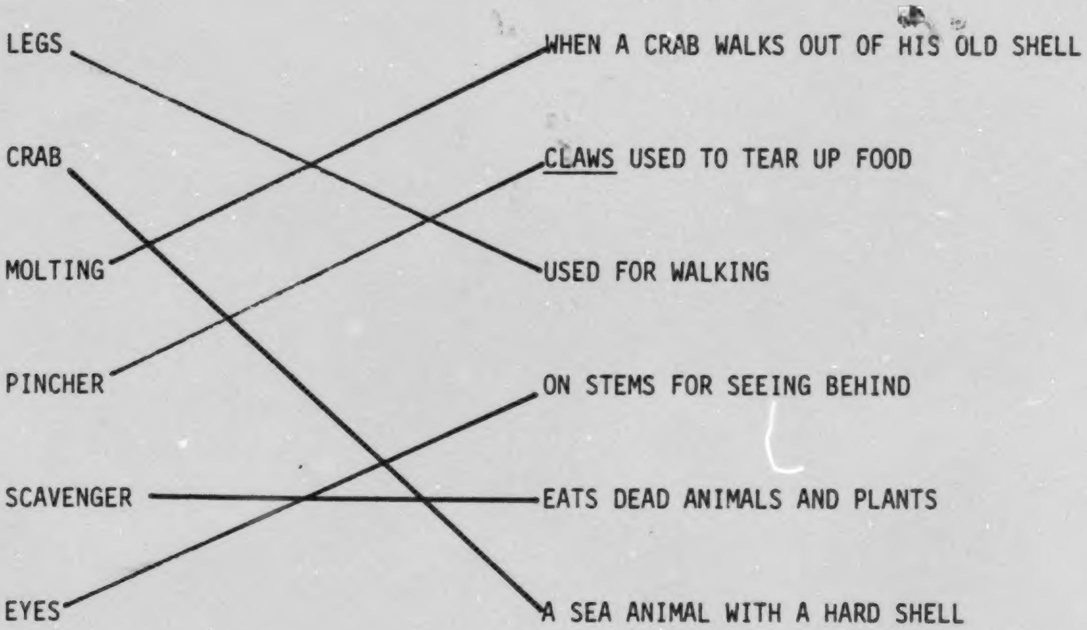
Legs	No legs
Eyes	No eyes
More than five legs	Five or less legs
Soft surface covering	Hard surface covering

TEACHER BACKGROUND - Find The Meaning

"Find the Meaning" is an activity described to reinforce vocabulary taught in the text. The discussion of this activity may be used as a summary for the section "Crabs". Stress the adaptations that crabs have evolved which make them successful in the struggle for survival.

Duplicate the "Find The Meaning" sheet. One sheet is recommended for each student. This activity may be done individually or in small groups. Alternatively, it may be done first individually, then, in small groups with the students meeting to discuss their answers and solve problems. Regardless of the procedure adopted, devote a few minutes to providing the correct answers, and to a discussion of the basic concepts covered. The "Key Words" should be taught if they are unfamiliar to your students.

KEY



LEGS — WHEN A CRAB WALKS OUT OF HIS OLD SHELL

CRAB — CLAWS USED TO TEAR UP FOOD

MOLTING — USED FOR WALKING

PINCHER — ON STEMS FOR SEEING BEHIND

SCAVENGER — EATS DEAD ANIMALS AND PLANTS

EYES — A SEA ANIMAL WITH A HARD SHELL

KEY WORDS

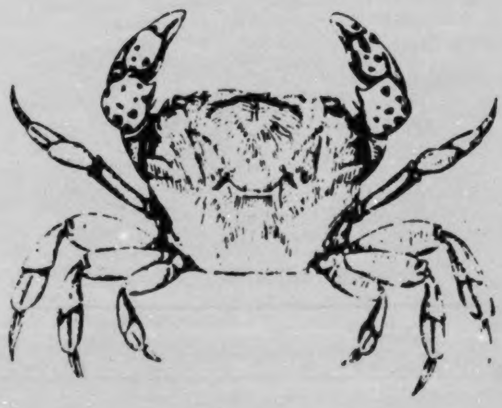
behind
claws
crab
eyes
legs
molting
pincher
scavenger
walking

Name________________________

FIND THE MEANING

Draw a line from each word to its meaning. The first one is done for you.

WORD	MEANING
legs	When a crab walks out of his old shell
crab	Claws used to tear up food
molting	Used for walking
pincher	On stems for seeing behind
scavenger	Eats dead animals and plants
eyes	A sea animal with a hard shell



TEACHER BACKGROUND - Draw Your Own!

"Draw Your Own!" is a fun introduction to an easy way to draw animals. This technique requires careful observation of the thing to be drawn since the object must be translated into simple, basic shapes.

Duplicate the activity pages. One set is recommended per student. Announce that your students will be using basic shapes to draw a sea star, a parrotfish, and a crab. This exercise provides practice in following directions. While it is possible for you to demonstrate the procedure in its entirety on the blackboard, you will find that, if you do, you will have a class set of reproductions of your drawing. A better plan is to have one or two students draw the animals at the blackboard as you read the directions. The last page provides space for each student to use the techniques learned to draw their favorite sea animal. Decorate your room with the artistic creations before you send them home.

KEY - see drawings that follow.

KEY WORDS

basic

circle

lateral

oval

parrotfish

rectangle

shapes

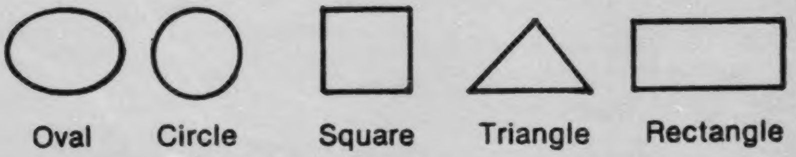
square

triangle

KEY

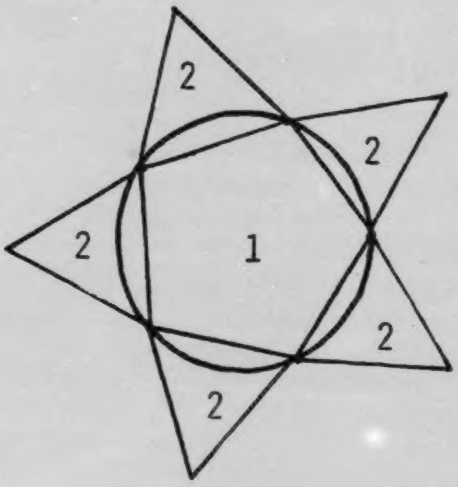
DRAW YOUR OWN!

Use these basic shapes
To draw sea animals.
Let's draw a sea star.

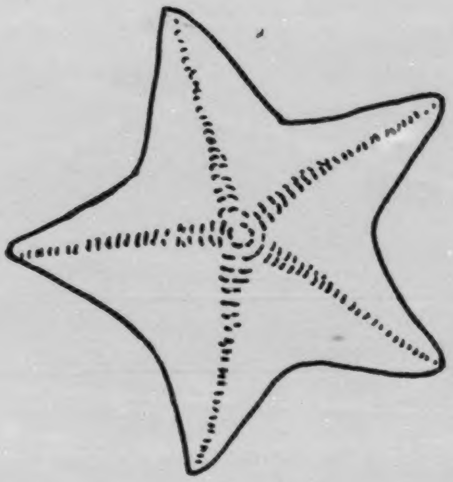

Oval
Circle
Square
Triangle
Rectangle

Here's how:

1. Start with a large circle for the body.
2. Add five triangles for legs.
3. Smooth the lines. Add spines. Color your starfish.



3.

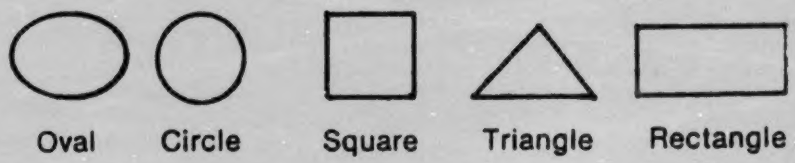


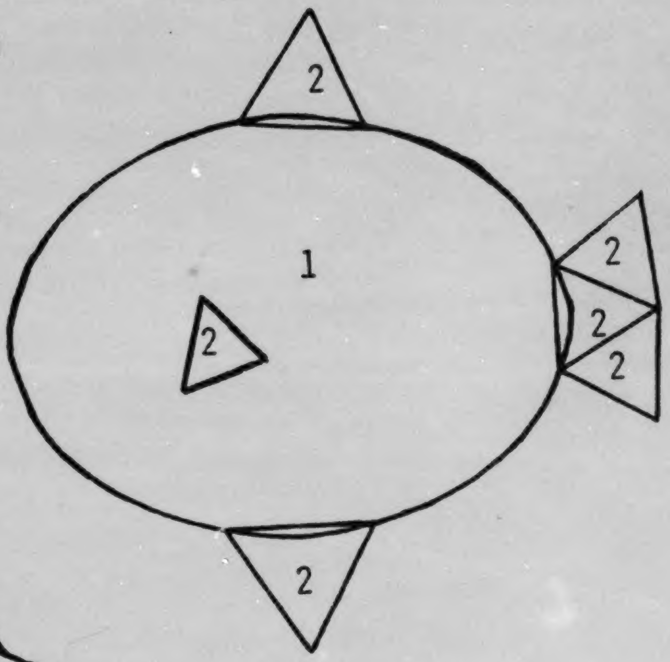
KEY

Now let's draw a parrotfish.

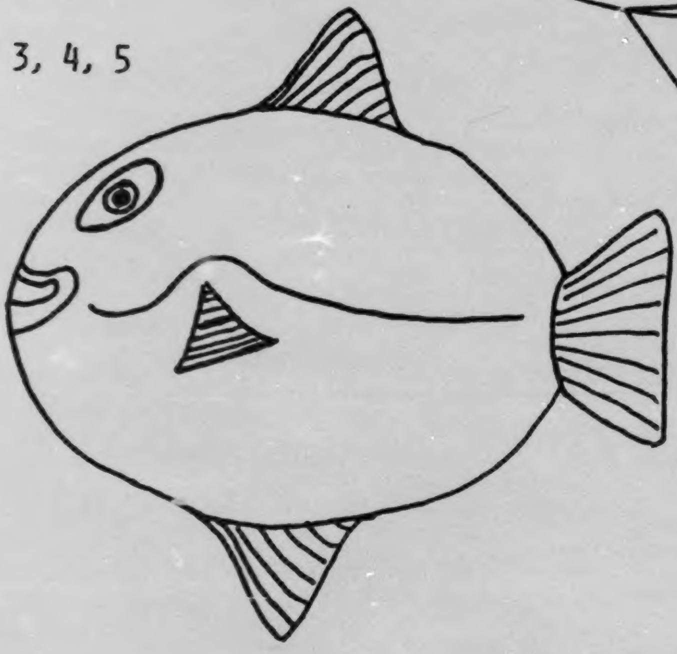
Here's how:

1. Draw a large oval for the body.
2. Add six triangles for fish.
3. Smooth the lines. Add rays to the fins.
4. Add the mouth and eye.
5. Add the lateral (side) line. Color your parrotfish.


Oval
Circle
Square
Triangle
Rectangle

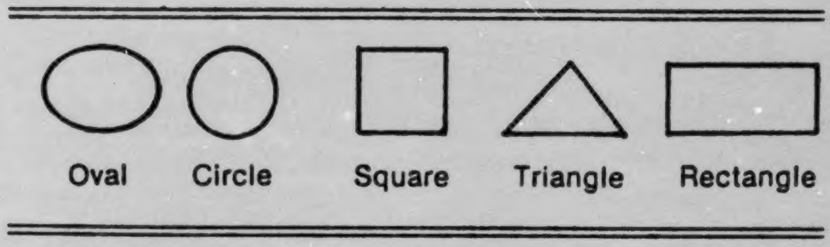


3, 4, 5

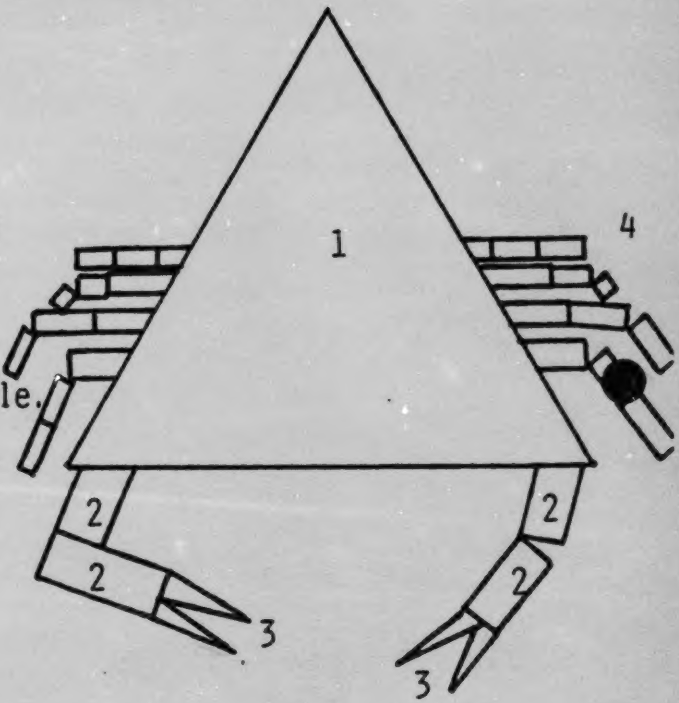


KEY

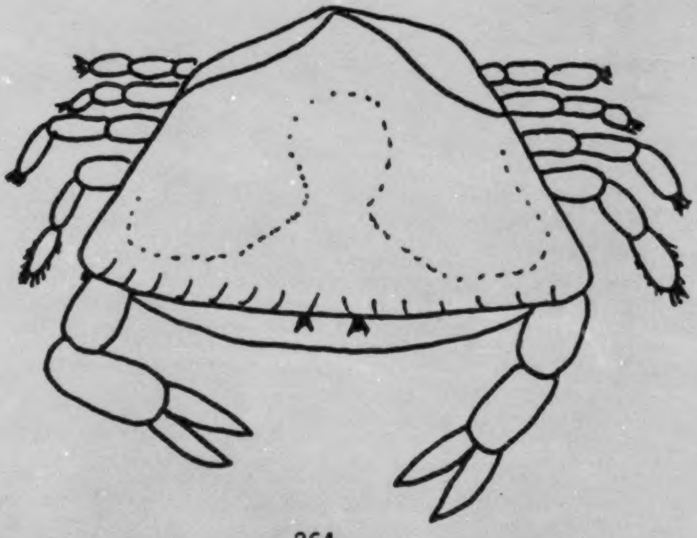
Here's a fun one! Let's draw a crab. Here's how:


Oval
Circle
Square
Triangle
Rectangle

1. Start with a large triangle for the body.
2. Add four rectangles for the pinchers.
3. Add four triangles for the claws.
4. Make four legs on each side. Use three rectangles for each leg.
5. Round the leg lines.
6. Erase the top of the triangle.
7. Add eyes and markings. color your crab.



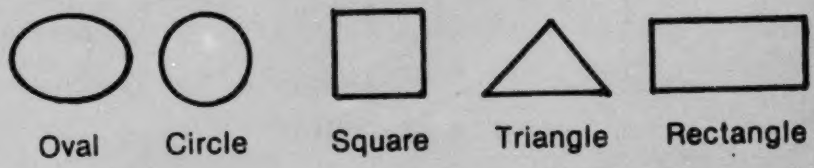
5, 6, 7



Name ______________________________

DRAW YOUR OWN!

Use these basic shapes to draw sea animals. Let's draw a sea star.


Oval
Circle
Square
Triangle
Rectangle

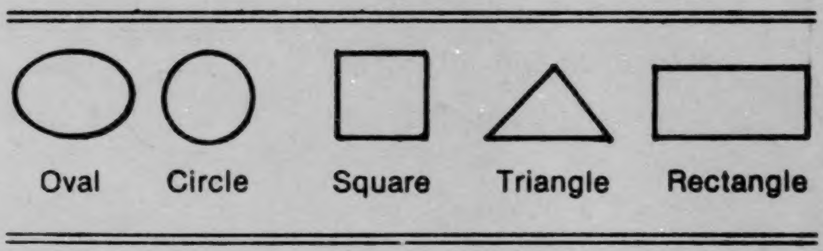
Here's how:

1. Start with a large circle for the body.
2. Add five triangles for legs.
3. Smooth the lines. Add spines. Color your starfish.

Name ______________________________

Now let's draw a parrotfish.

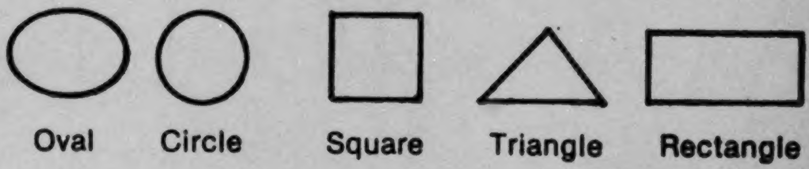
Here's how:


Oval
Circle
Square
Triangle
Rectangle

1. Draw a large oval for the body.
2. Add six triangles for fish.
3. Smooth the lines. Add rays to the fins.
4. Add the mouth and eye.
5. Add the lateral (side) line. Color your parrotfish.

Name ______________________________

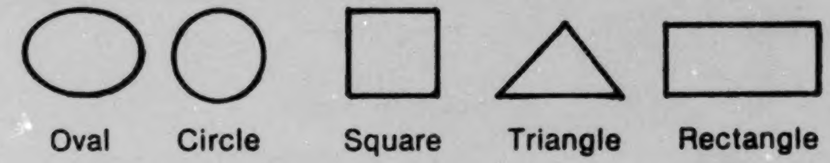
Here's a fun one! Let's draw a crab. Here's how:


Oval
Circle
Square
Triangle
Rectangle

1. Start with a large triangle for the body.
2. Add four rectangles for the pinchers.
3. Add four triangles for the claws.
4. Make four legs on each side. Use three rectangles for each leg.
5. Round the leg lines.
6. Erase the top of the triangle.
7. Add eyes and markings. color your crab.

Name ______________________________ Page 4

You can use these shapes to draw other sea animals too!


Oval
Circle
Square
Triangle
Rectangle

Look at me! I am a _______________________.

TEACHER BACKGROUND - Crab Boats

"Crab Boats" is a fun activity that can easily be expanded to include bouyancy, floatation, and other related concepts.

Duplicate the activity pages. One set is recommended per student. The basic concepts covered need to be discussed by the teacher. The "Key Words" should be taught if they are unfamiliar to the students. This is a good activity for individual participation. Caution your students on the use of scissors and supervise the cutting of the cartons. Allow ample time to help those students who need it. You can provide completed boats to serve as models. Have your students decorate their creations. Provide time for a discussion of the results and to answer the questions.

KEY

6. a. The boats carry a load. They carry flat, low loads best.

   b. The amount carried depends upon the individual boat but can be surprisingly high.

6. a. The powerboat can also carry a load.

   b. The amount depends upon the individual boat.

KEY WORDS

boats
cartons
hairpin
half
hulls
lengthwise
load
masts
paddle
paddle wheel
rectangle
sails
scissors
staple
straw
squares
wheel

Name ______________________________ Page 1

CRAB BOATS

Crab boats come in all shapes. You can make your own crab boats.

Here is what you'll need:

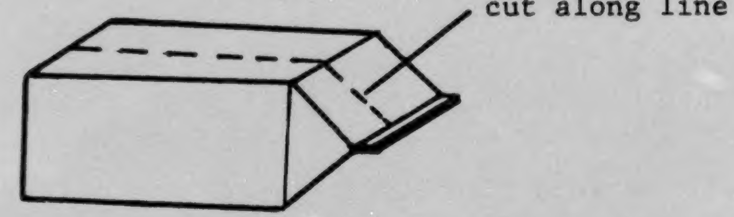
Materials:

milk cartons
straws
paper
scissors
glue or staples
rubber band
two hairpins

Here is how to make your first boat:

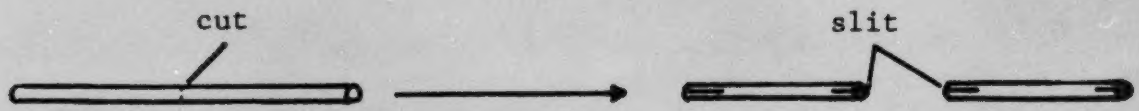
Procedure:

1. Cut your carton in half lengthwise.



These will be the hulls.

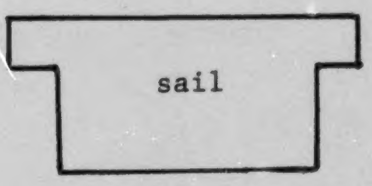
2. Cut a straw in half. Cut a slit in each end of the straw pieces.



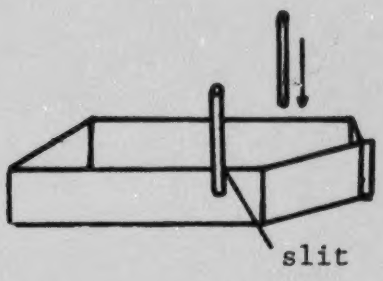
These will be the masts.

Name ______________________________ Page 2

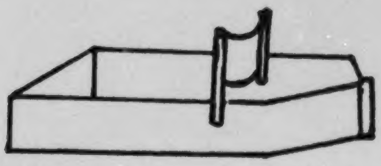
3. Cut a piece of paper for the sail.



4. Slip one straw onto each side of the hull. Glue or staple them in place.



5. Slip your sail into the top slits of the masts.



6. You are now ready to sail.

a. Can your sail boat carry a load? ______________________________

b. How much can it carry? ______________________________

____

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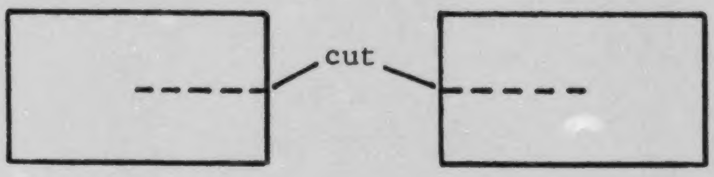
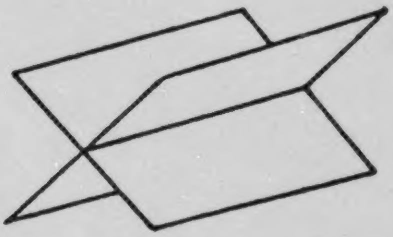
Name ______________________________

Most modern crab boats have motors. Use your second hull to make a motor boat. Here is how to do it:

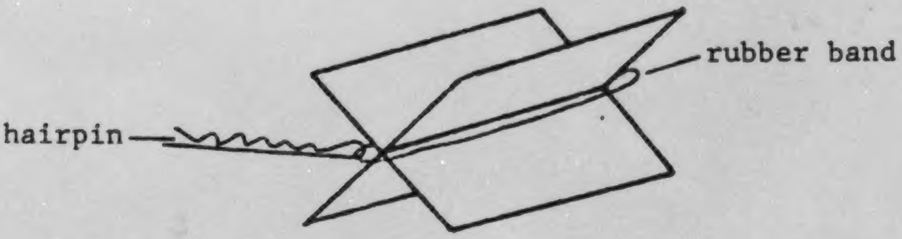
1. Make a paddle to fit your boat. Use parts of another milk carton. Cut two rectangles. Cut each rectangle way up the middle.



Slide the two rectangles together to make the paddle wheel.



2. Put your rubber band on your paddle wheel.

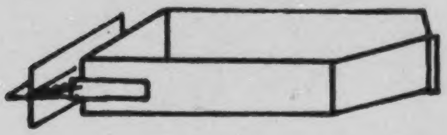


3. Slip one hairpin through each end of the rubber band.

Name ______________________________ Page 4

4. Cut two squares from the extra carton paper. Glue or staple these pieces on the sides of your hull next to the back. The hairpins will attach to these squares.

5. Attach the paddle. Do not let the paddle touch the hull.



6. Wind the paddle. Put the paddle below the water level. Let'er go!

a. Can your power boat carry a load? ______________________________

b. Can it carry more or less than your sailboat? ______________

____

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HERMIT CRABS

TEACHER BACKGROUND - Hermit Crabs

"Hermit Crabs" is a short section that compliments the preceding section. Hermit crabs are interesting creatures and are readily available in pet stores. They are easy to keep and it is recommended that you obtain one for this unit.

In this section on hermit crabs, we see how the sometimes unwanted moon snails and shelks play a part in the total picture. Without the use of the empty shells of other animals, the hermit crab would become very vulnerable to its enemies. With the exception of its big pinchers, the hermit crab is rather soft shelled.

Duplicate the text "Hermit Crabs" one set per student is recommended. The basic concepts covered in the reading need to be discussed by the teacher. The "Key Words" should be taught if they are unfamiliar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

Pagoo by Holling Clancy Holling (Houghton Mifflin Company, Boston. 1957) tells an interesting life story about Hermit Crabs. There is an excellent film, with the same name, that portrays this story and shows the hermit crab in action. "Story of a Book", a sound film by Churchill Films, tells how the book *Pagoo* was made. Its purpose is to teach children the steps followed in making a book--from the idea for a book to its printing. The film includes activities. The same information is avilable on a film-strip and record by Pied Piper, copyright MCMLXX, called "Story of a Book". Consult your film sources for more information.

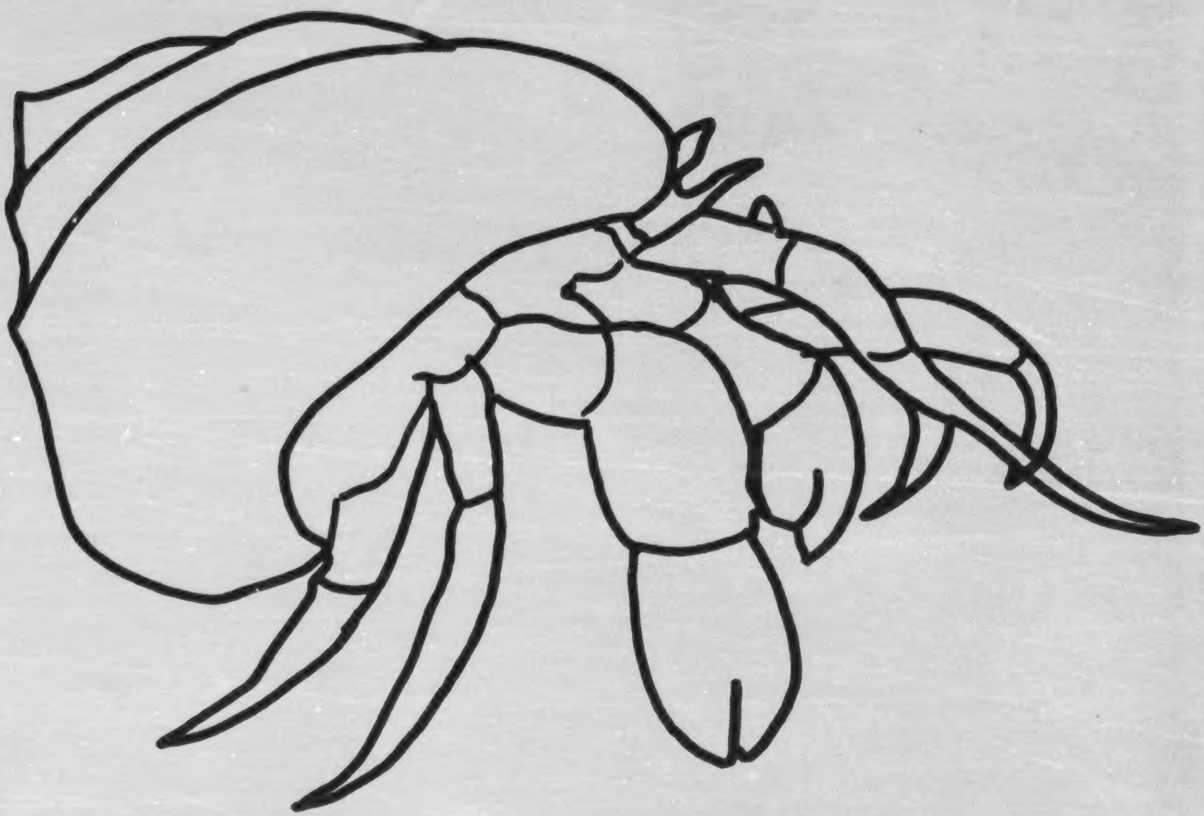
KEY - Text questions

1. There are four legs on the outside of the shell.
2. A hermit crab borrows an empty shell.

KEY WORDS

borrow
hermit crab
pincher
shell
slime
tide pools

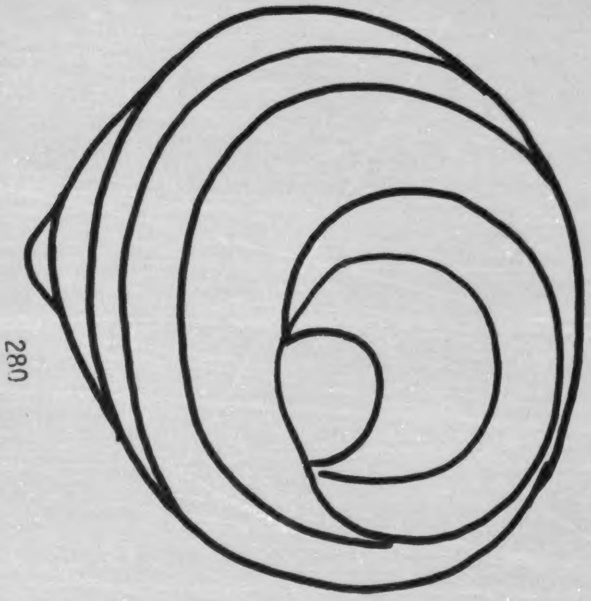
hermit crab

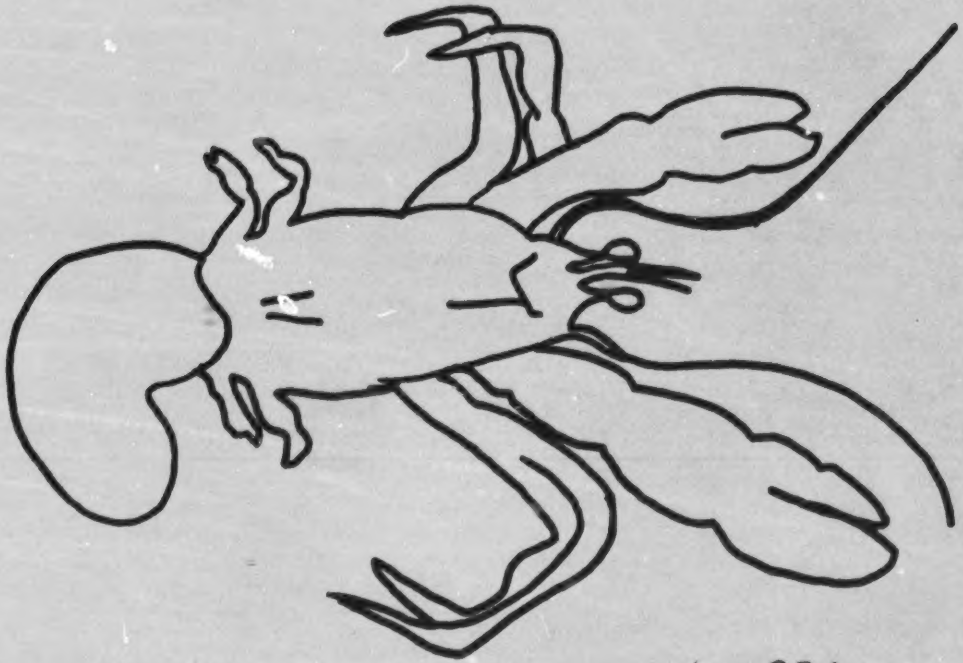


Out for a walk...

1. I'm a ______________ ______________.
2. Color my new home.
3. Color me.

hermit crab



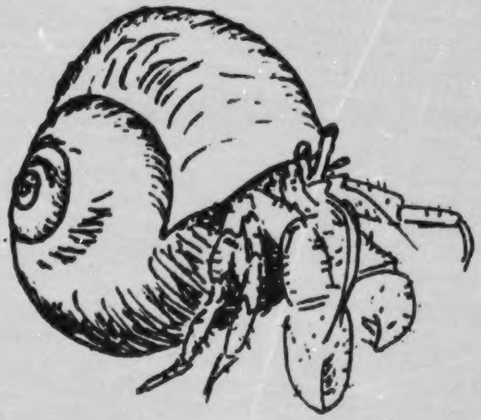


1. I'm leaving this shell for
   a new ______________.
2. I had to leave because ______
   ________________________________.
3. Draw me a new home.
4. Color me.

Name ______________________ Page 1

HERMIT CRABS

The hermit crab likes to crawl into the shells of water snails. When the hermit crab grows too large for a shell, he looks for a new one. He wants to find one that fits just right. He has eight legs and two pinchers. The hermit crab puts four of his legs on the inside of the shell.

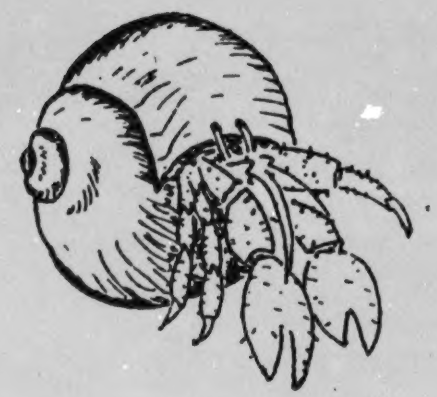


A Hermit Crab

1. How many legs are on the outside of the shell? ____________

____

Hermit crabs live in tide pools. They eat tiny sea plants or slime on rocks. They eat tiny dead animals too.

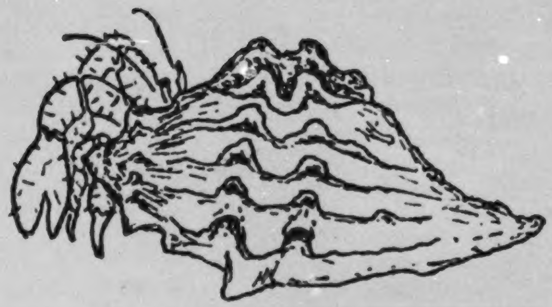


A Hermit Crab

2. What does a hermit crab borrow? ______________

____

____



A Hermit Crab

TEACHER BACKGROUND - The Ol' Shell Game

This activity helps reinforce the material covered in the text. It also provides a glimpse of the variety which exists in sea shell form and size.

Duplicate game pages. One set per student is recommended. This activity may be performed independently or in small groups. The basic concepts covered should be discussed. The "Key Words" should be taught if they are unfamiliar to the students. Allow a few minutes upon completion of the exercise for discussion of the correct answers. Emphasize the protection afforded the hermit crab through this behavior as well as the danger involved everytime he outgrows his home.

KEY

1. Hermy needs to fit four legs inside the shell.
2. Hermy puts his tail end into the shell. He actually "tries the shell on" by placing a pincher inside to examine the size and inhabitants. He then taps the shell with his pincher and if all suits his taste, he backs in and settles down.
3. Shell number 1 will fit Hermy the best. Discuss the differences in shape and size of the shells shown. If any of your students has a shell collection, this would be a good time for "show and tell".
4. Hermy needs to find a new shell quickly to avoid being eaten.
5. Hermy will have a problem since the shell is already occupied! Hermit crabs can close off the opening of the shell with one of their pinchers after they pull their body inside. This makes the shell look unoccupied. Hermy would not choose this shell since he would be at an obvious disadvantage in a dispute.

KEY WORDS

problem

shell

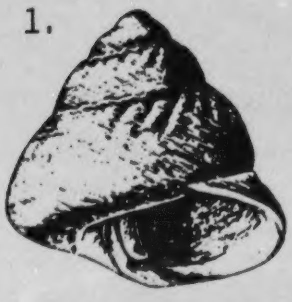
quickly

Name ______________________________ Page 1

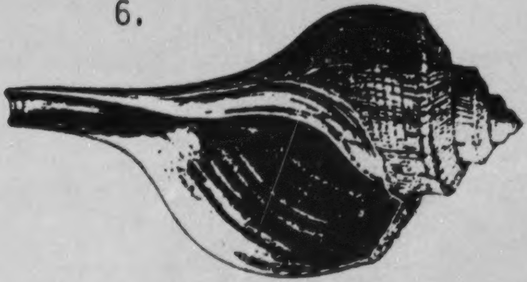
THE OL' SHELL GAME

Poor Hermy has outgrown his shell. Help Hermy find a new shell. Answer the questions on the next page.

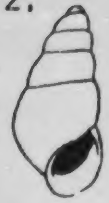
1.

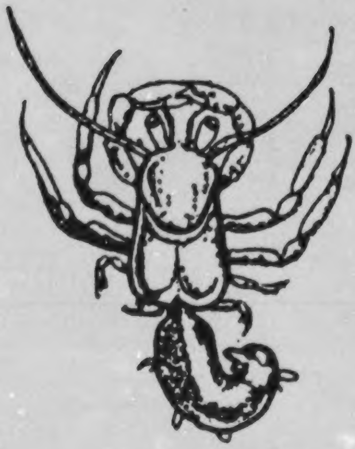


6.



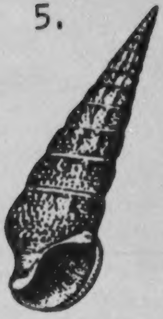
2.



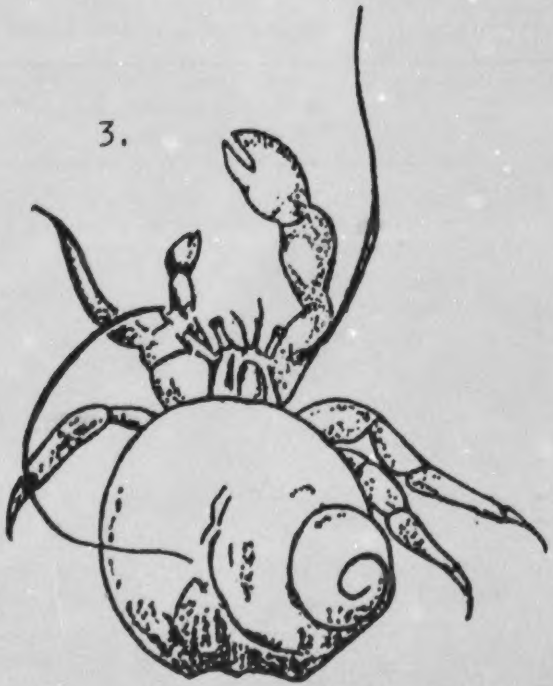


Hermy

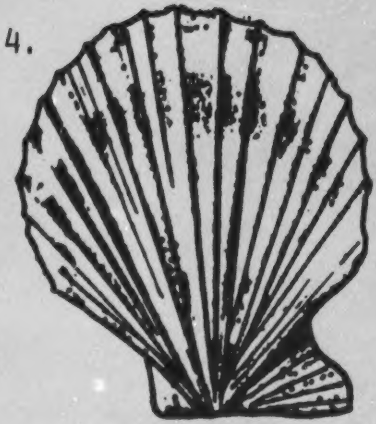
5.



3.



4.



Name ______________________

1. How many legs does Hermy need to fit inside the shell? ______

2. Which end does Hermy put into the shell? ______

3. Which shell will fit Hermy the best? ______

4. Why does Hermy need to find a new shell quickly? ______

5. Hermy likes shell #3. What problem will he have if he chooses #3? ______

TEACHER BACKGROUND - I Fall To Pieces

"I Fall To Pieces" is an exercise in visual discrimination. This exercise furthers the skills necessary for the careful observation which science stresses. Visual discrimination also plays a major role in developing reading skills.

Duplicate an"I Fall To Pieces" sheet for each student. This exercise is best done independently but if you situation so dictates, small groups may be used. Provide a few minutes to go over the correct answers.

After the matching portion of the exercise is completed, students may cut and paste the halves together and then color the completed marine organisms.

KEY - Lines

PLEASE SEE NEXT PAGE

KEY WORDS

half (Halves)

match

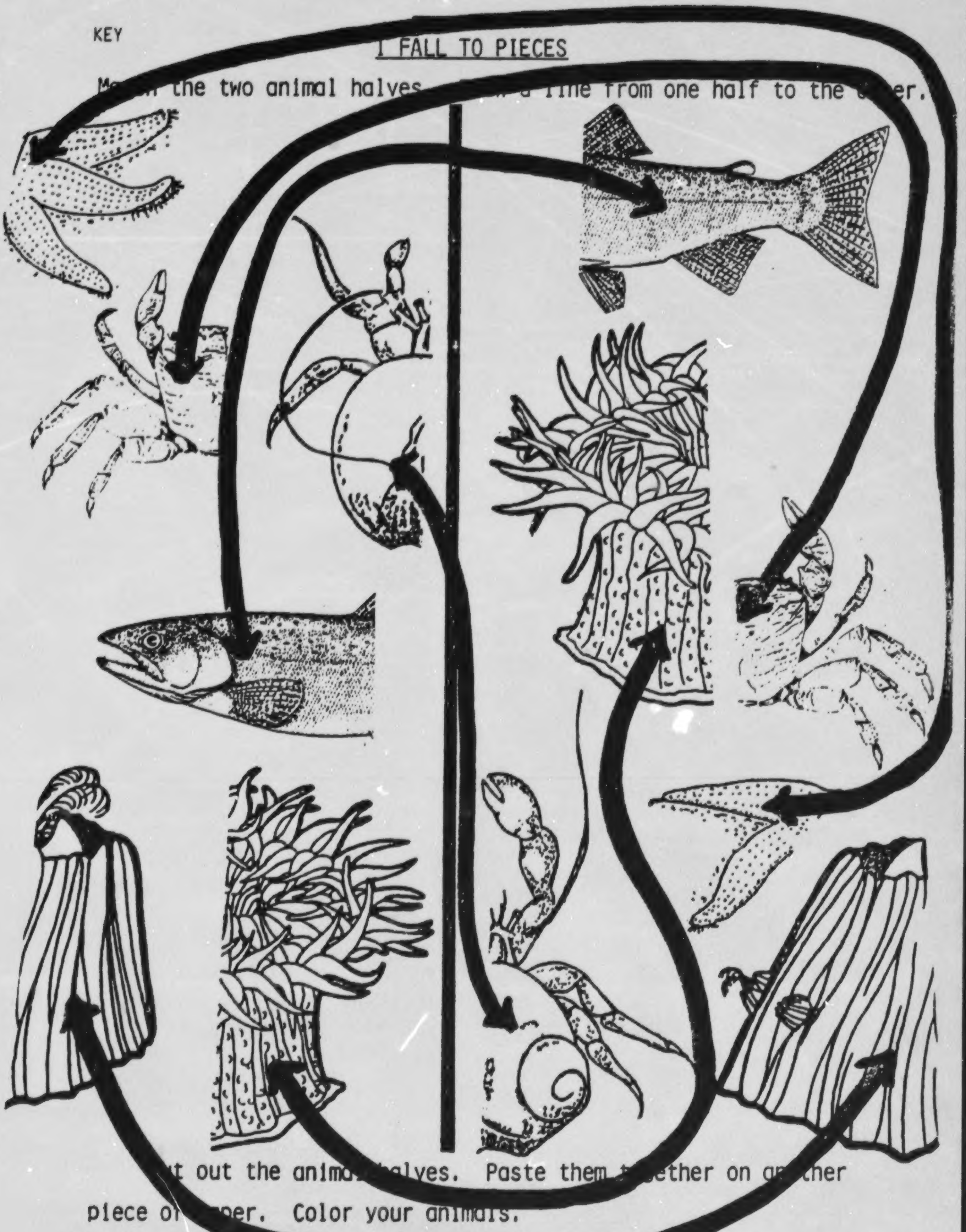
paste

pieces

KEY

I FALL TO PIECES

Match the two animal halves. [illegible] a line from one half to the other.

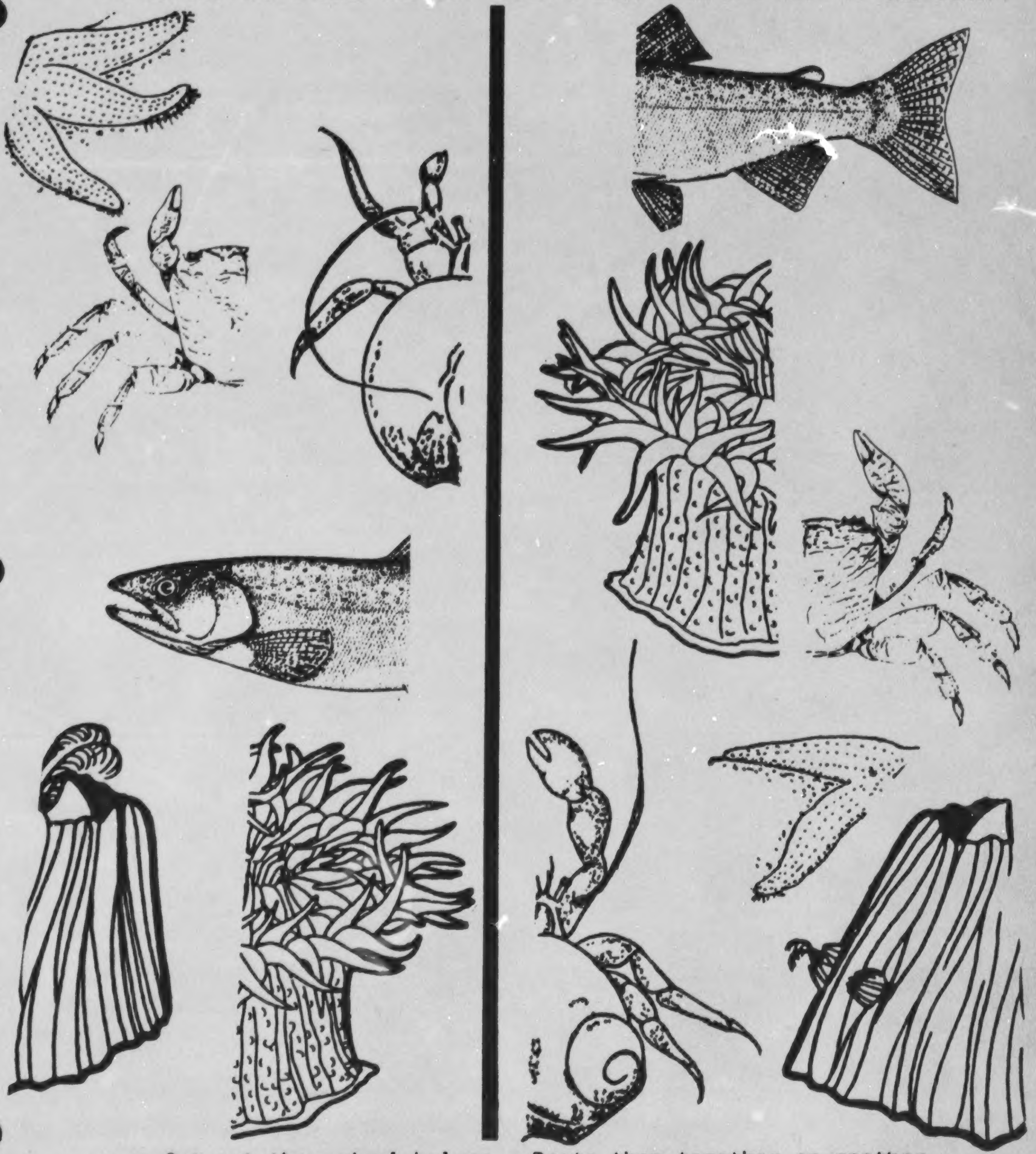


Cut out the animal halves. Paste them together on another piece of paper. Color your animals.

Name ______________________________

I FALL TO PIECES

Match the two animal halves. Draw a line from one half to the other.



Cut out the animal halves. Paste them together on another piece of paper. Color your animals.

LIMPETS AND CHITONS

TEACHER BACKGROUND - Limpets and Chitons (Ki tons)

Limpets and chitons are common and commonly overlooked shore animals. These two mollusks spend a good portion of their lives firmly attached to rocks.

In discussion of this section draw the students' attention toward the differences between free swimming and fixed animals. If possible, the student should have the opportunity to observe a limpet or chiton attached to the aquarium glass. It is interesting to note that although both chitons and limpets move during certain periods of the day, they return to precisely the same spot after their travels.

Comparisons can be made between the types of shells limpets possess and those chitons possess. The students might try to distinguish the difference in the feeding patterns or habits of the two animals. On occasion chitons and limpets can be pried loose from their foot hold if proper pressure is quickly exerted before the limpet or chiton has the chance to clamp down firmly.

It might be pointed out that the seaweed or algae that these two kind of animals eat is very small but nevertheless visible (macroscopic). A substantial quantity of this algae may be obtained for closer inspection by scraping the inside surface of the aquarium.

Although the number and kinds of algae specimens capable of being maintained in an aquarium are very limited, the concepts dealing with the interrelationships between plants and animals are very important and should be discussed with the students. The existence of any species of animal is directly or indirectly related to the existence of some species of plant. Algae acts as a source of food and a source of oxygen in the marine world.

Duplicate the text pages. One set per student is recommended. The "Key Words" should be taught if they are unfamiliar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

KEY - Text questions

Limpets

1. Limpets eat seaweed.
2. Limpets have a single foot.

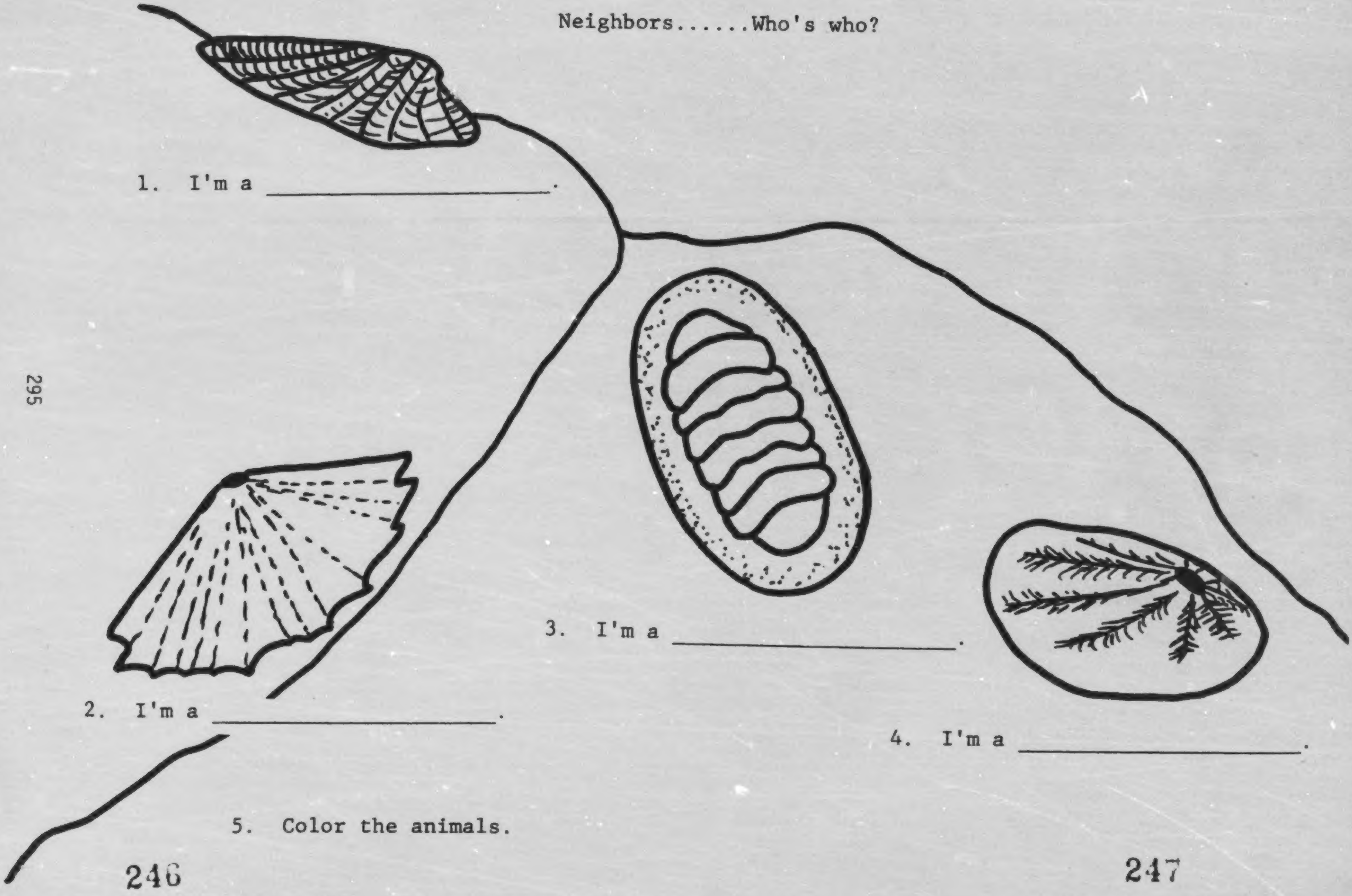
Chitons

1. Chitons have eight shell plates.
2. Chitons protect themselves by rolling into a ball.

KEY WORDS

chitons
foot
limpets
plates
protection
pried
seaweed

Neighbors......Who's who?



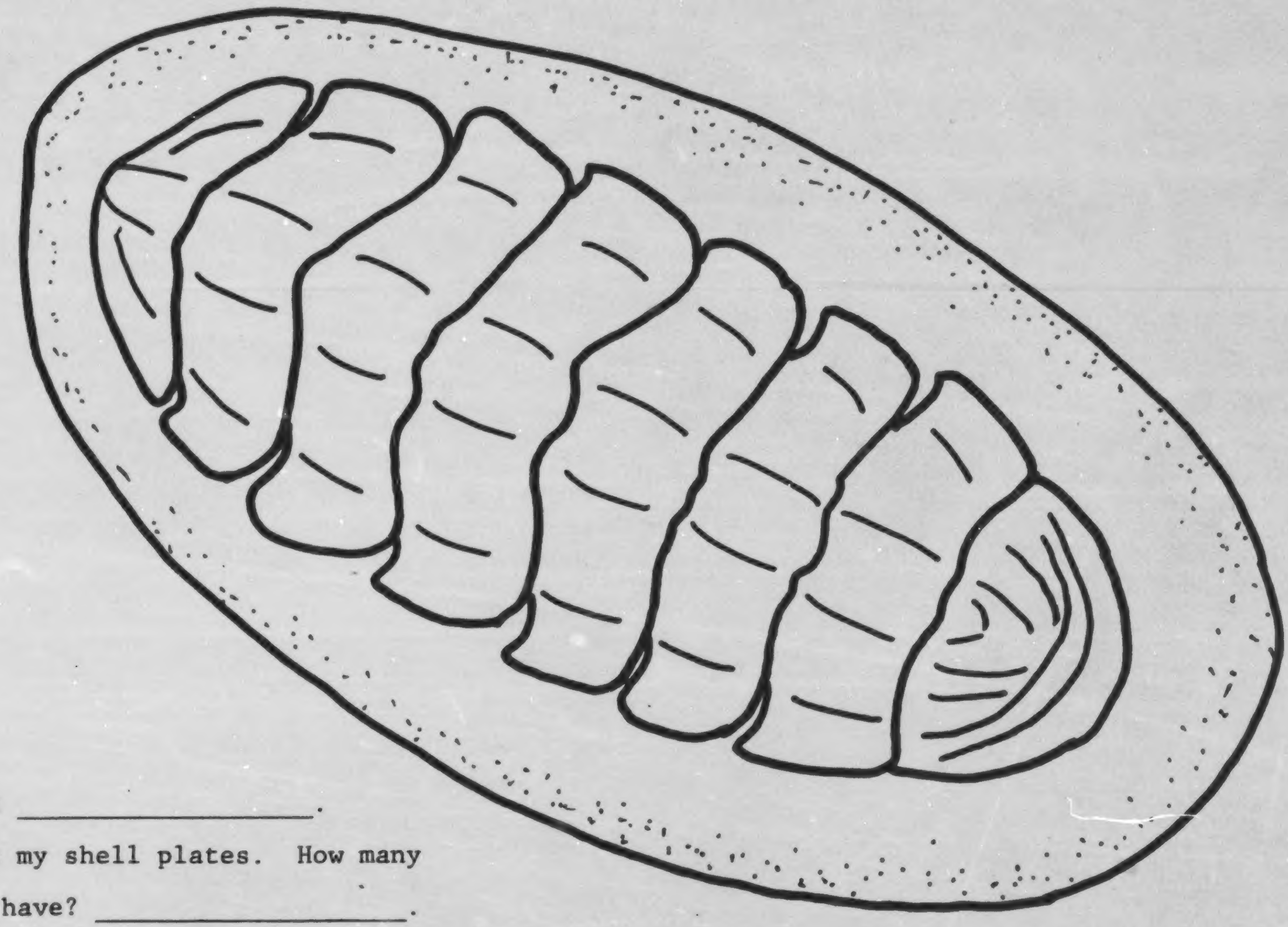
1. I'm a ________________________.

2. I'm a ________________________.

3. I'm a ________________________.

4. I'm a ________________________.

5. Color the animals.



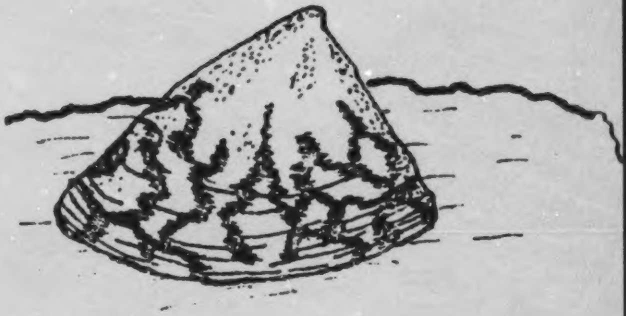
297

1. I'm a __________________.
2. Count my shell plates. How many do I have? __________________.
3. I live on ____________________.
4. Color me.

Name ______________________________

LIMPETS

This is a limpet on a rock. Sometimes a limpet will look like a part of the rock it is sitting on. Limpets eat seaweed.



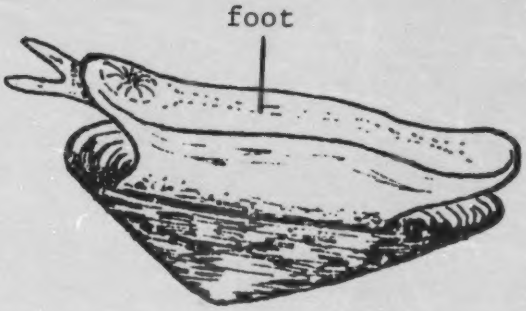
A limpet on a rock

1. What do limpets eat?

____

____

If you turn a limpet over this is what you will see.



A limpet upside down

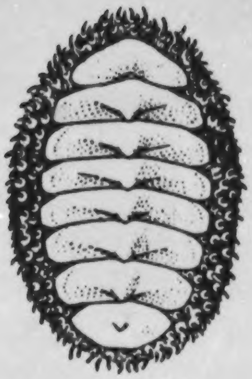
2. How many feet does a limpet have?

____

____

Name ___________________________

CHITONS



A Chiton

Chitons (ki ton) live on rocks. Sometimes they can be mistaken for a rock. Chitons have eight shell parts. The shell parts are called plates.

1. How many shell plates does a chiton have?

____

____

A chiton has a foot which it uses to hold itself onto rocks. A chiton will roll into a ball for protection when it is pried from a rock.

2. How does a chiton protect itself?

____

____

TEACHER BACKGROUND - On The Rocks

"On The Rocks" requires the student to separate a list of facts into two catagories. The content is taken directly from the text material. However, the "Key Words" should be taught if they are unfamiliar to the students.

Duplicate the activity page. One page per student is recommended. The students may work independently or in small groups. By now, you should have a feeling for how your class functions best with these activities. Modify the procedure to suit your particular needs. Allow a few minutes at the end of the activity for a discussion which includes the correct answers. In your discussion, focus on the idea of a relatively fixed animal and the advantages and disadvantages to this sedentary lifestyle.

KEY

Please see the next page for correct lines.

KEY WORDS

connect

foot

list

plates

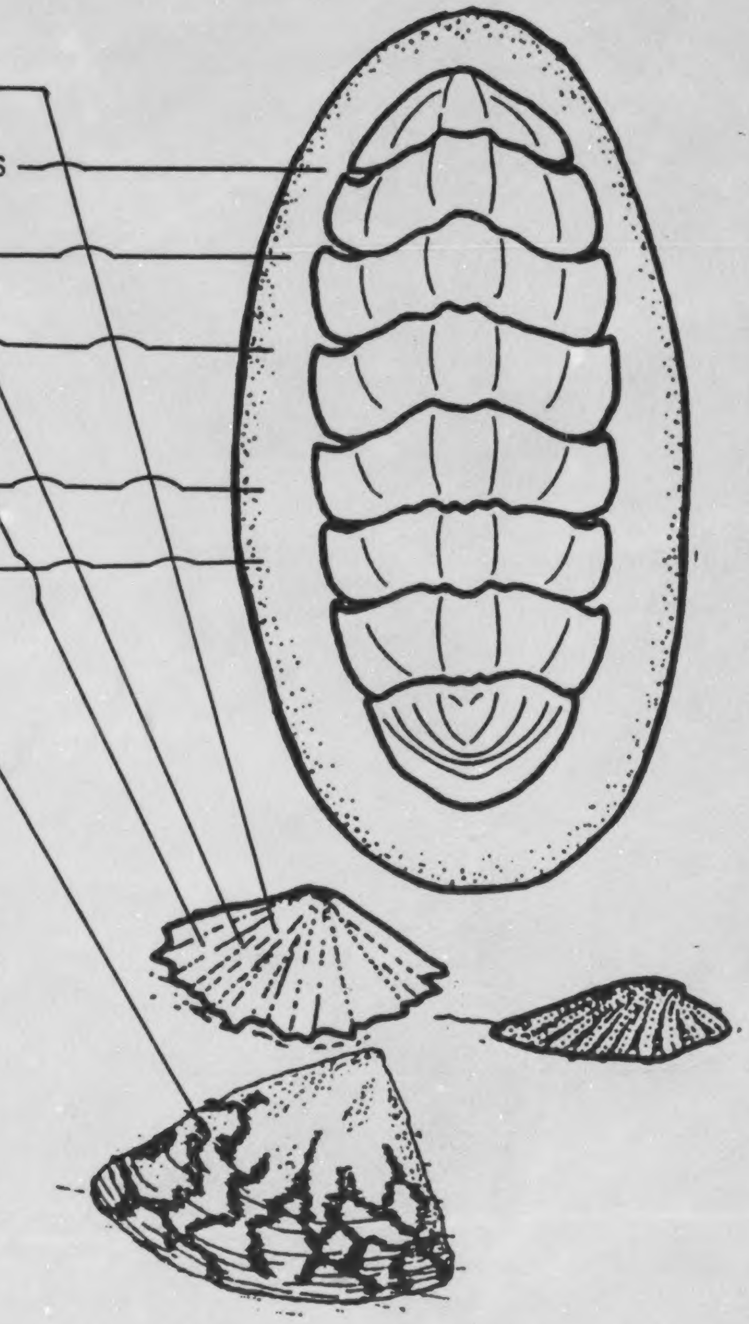
protection

seaweed

shell

KEY

1. One shell
2. Eight shell plates
3. Lives on rocks
4. Eats seaweed
5. Has a foot for holding
6. Rolls into a ball for protection

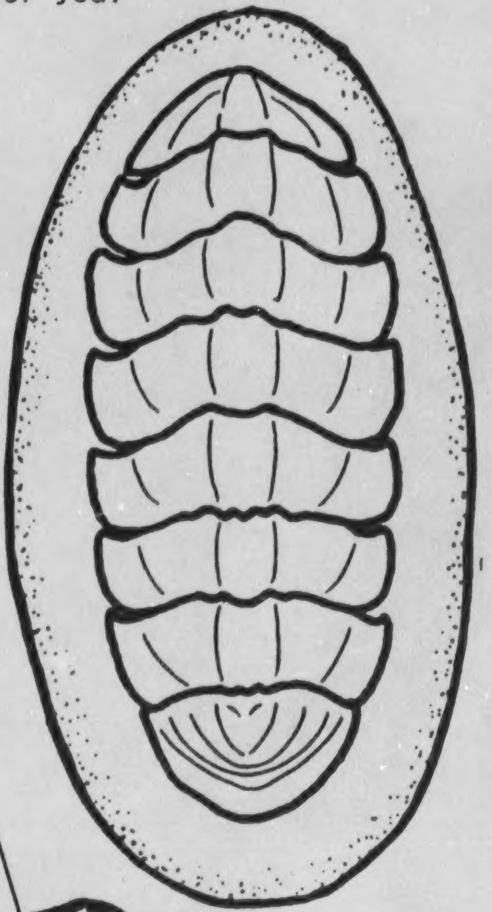


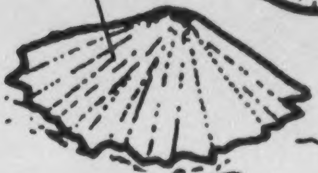
Name ______________________________

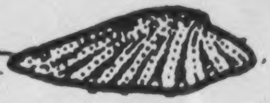
ON THE ROCKS

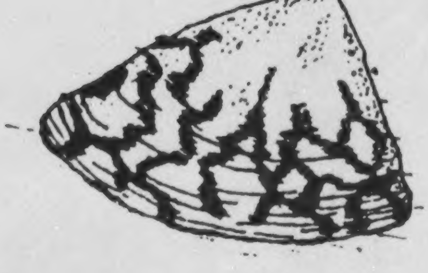
Match the things on the left with the correct animal or animals on the right. The first one is done for you.

1. One shell
2. Eight shell plates
3. Lives on rocks
4. Eats seaweed
5. Has a foot for holding
6. Rolls into a ball for protection







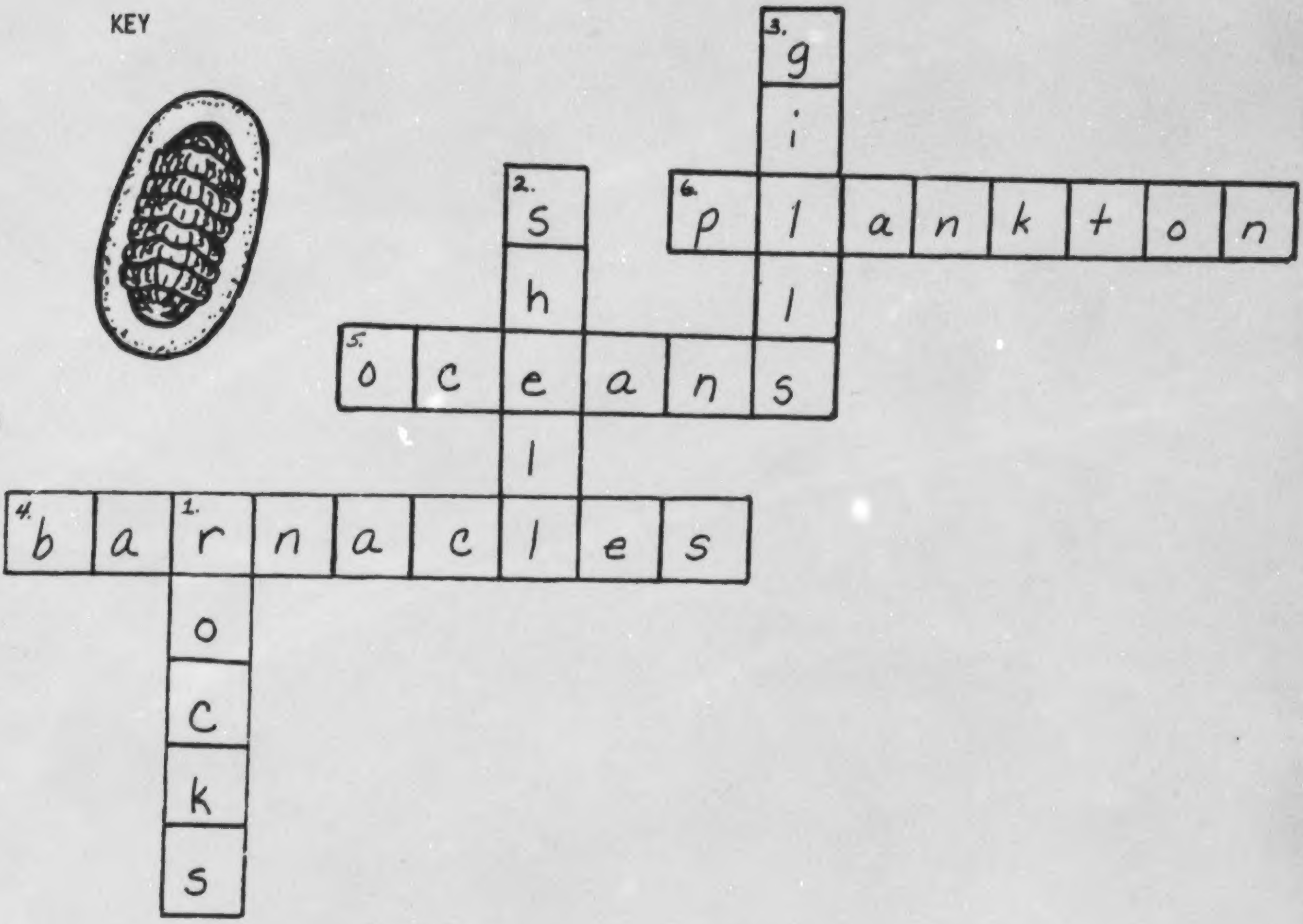


TEACHER BACKGROUND - Sea Cross

This crossword puzzle is designed as a review of the material covered to date. The vocabulary needed is listed on the puzzle page. Those words unfamiliar to the students should be taught.

Duplicate the puzzle. One puzzle per student is recommended. Students may work individually or in small groups. Material exchange in small groups is often helpful in this type of vocabulary exercise. Be certain that your students understand how to do a crossword puzzle. Note that this puzzle has a simplified numbering scheme. Provide the assistance necessary to get your class started on this exercise.

KEY

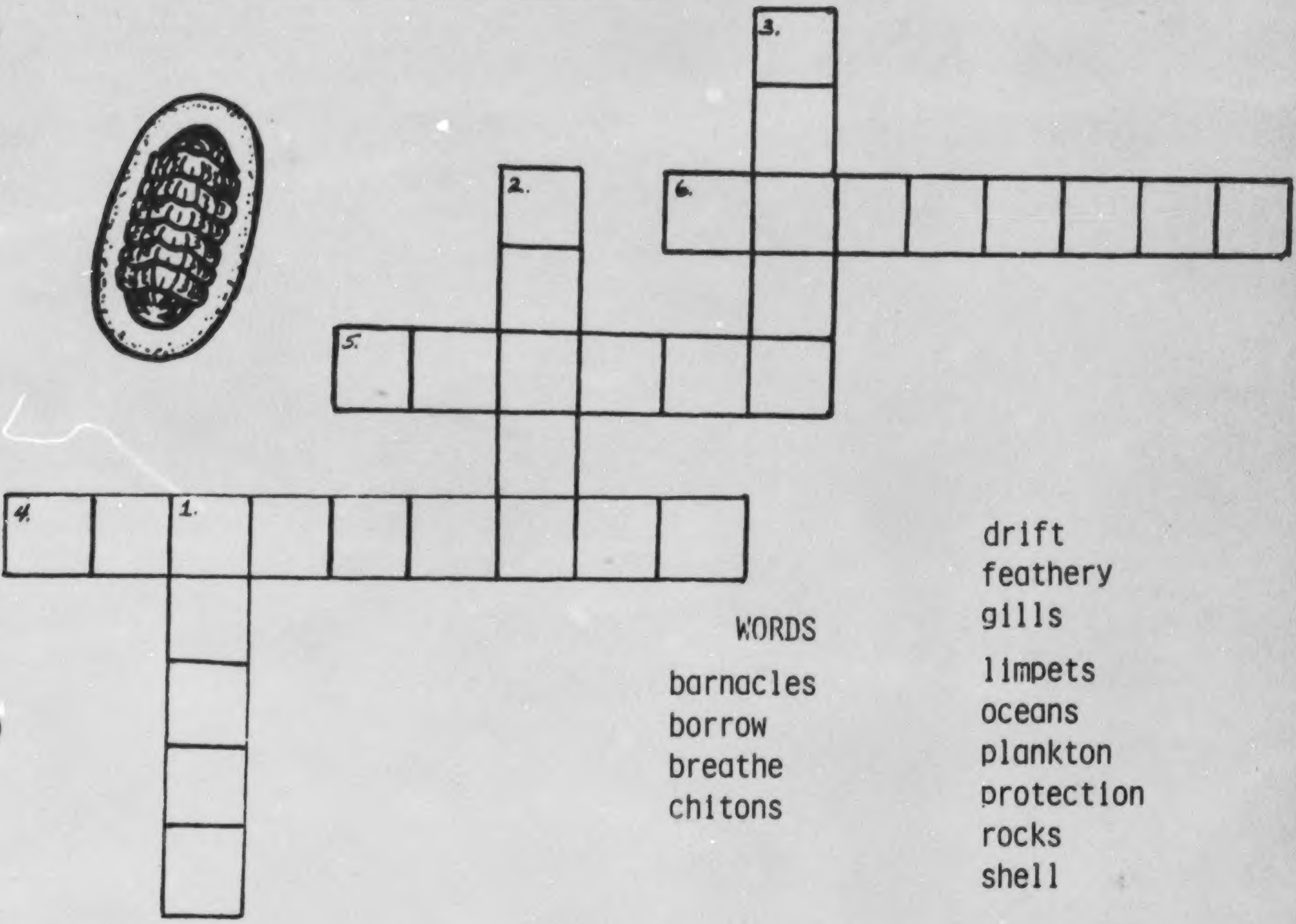


KEY WORDS

The "Key Words" are those reinforced by the crossword puzzle.

Name ______________________________

SEA CROSS



WORDS

barnacles
borrow
breathe
chitons

drift
feathery
gills
limpets
oceans
plankton
protection
rocks
shell

1. Barnacles, limpets and chitons sometimes live on
____.

2. A hermit crab must borrow another animal's_______________ for protection.

3. Most sea animals breath with ______________________________.

4. ______________________use their feathery legs to catch their food.

5. Large bodies of water are called __________________________.

6. Tiny plants and animals that drift in the water are called
____.

TEACHER BACKGROUND - Visual Aid

"Visual Aid" provides your students with the opportunity to create and then use a microscope. These water microscopes can be used to examine some of the principles of optics as well as to examine small items.

Duplicate the instruction pages. One set per student is recommended. This activity works well in pairs or small groups. The "Key Words" should be taught if they are unfamiliar to the students. Plastic containers may be brought from home, made out of bleach bottles, etc. Cardboard paint containers may be purchased from paint or hardware stores. You may wish to demonstrate the construction prior to having your class do the activity. Some students will probably need help in tying the string. Plan to provide some time upon completion for discussion of the activity and of the questions.

KEY - Text questions

4. Your hand will go in and out of focus as you move it up and down.
5. Answers depend upon what you have provided to look at and your students' imaginations.
6. Newspaper photos are comprised of many tiny black dots.
7. Changing the tightness changes the focus point.
8. Depends upon the particular microscope.

KEY WORDS

bucket

image

knife

microscope

plastic

scissors

string

tightness

visual

water microscope

wrap

Name ______________________________ Page 1

VISUAL AID

Limpets and Chitons come in all sizes. Some are small. How can you study the small ones? Let's make a water microscope. Here is what you will need:

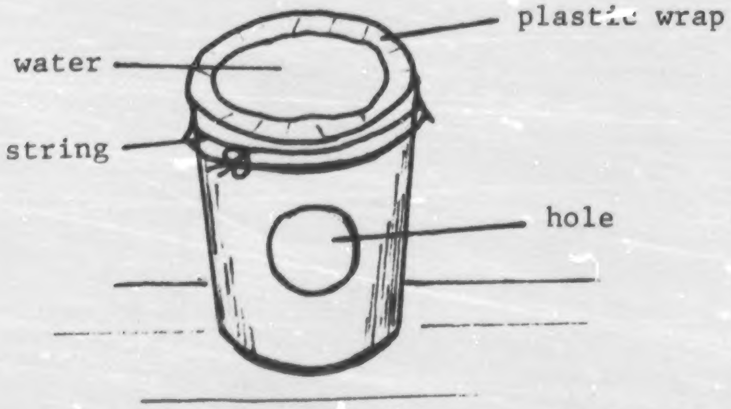
Materials:

a large plastic container (or a cardboard paint bucket)
plastic wrap
string
water
knife or scissors

Here is what you do:

Procedure:

1. Cut a hole in the side of the bucket. Make it big enough for your hand. Be careful!
2. Stretch the plastic wrap loosely over the top of the bucket. Wrap the string around the top of the bucket. Tie a knot in the string.
3. Fill the loose plastic wrap with water.



Name ______________________________ Page 2

4. Put your hand through the hole.

What happens when you move your hand up? ______________________

____

____

What happens when you move your hand down? ____________________

____

____

5. Look at shells and other small objects.

I looked at: ____

____

____

____

6. Look at a newspaper picture.

What do you see? ____

____

7. Change the tightness of the wrap.

What happens? ____

____

____

Name ______________________

8. (The image is what you see with your microscope). How many times larger than life is the image? Can you figure it out? Draw a line one inch long on a piece of paper. Put it under your microscope. Measure the length of the line in the image. How many time longer is the line in the image? ______________________
____

FOR REAL EAGLE EYES ....

Look at the back of a penny. How many steps are there on the Lincoln Memorial? ______________________

9. Clean up your work area.

CLAMS AND OYSTERS

TEACHER BACKGROUND - Clam and Oysters

Clams and oysters are common and economically important intertidal animals. Oysters have been raised commercially for many years. Most of the early research on mariculture was conducted on oysters. Today about ten million pounds of oysters are harvested each year. The oyster spat, or larva swims freely until it attaches to a rock or another oyster shell. The spat develops into the adult oyster in that location. Oyster farmers string shells on wires hung from floating rafts or lay the shells on the bottom. These strings of shells are harvested after about three years. The oysters are shucked, removed from their shells, and sold. The shells are re-strung and are ready for the next generation of oysters.

Clams are harvested by both commercial clammers and by sportsmen. The clam, unlike the oyster, digs its way under the sand. Clams vary in size from the small little neck clam with a maximum shell size of about 2 inches, to the giant geoduck, with a shell 10 inches long and a weight sometimes exceeding 10 pounds. Like the oyster, clams feed on tiny planktonic plants and animals.

Duplicate the text pages. One set per student is recommended. As always, be sure to provide any help needed to guarantee understanding by the members of your class. The "Key Word" should be taught if they are unfamiliar to the students.

Continue developing concepts dealing with classification and the interrelationships existing between the animals we have seen. The students should notice structural differences such as univalve versus bivalves. Students should be able to develop their own system of classification from their observations of similarities and differences.

Animal locomotion as it relates to the interrelationships between one animal and another (example--starfish and clam) may be developed with the students during their P.E. period where they can simulate the various movements.

"Clams and Oysters" offers many opprotunites for creative dramatics. You can elect to have the students conduct body movements to show the actions of 1) the foot and siphon of a clams extending and contracting; 2) the digging clams, covering the holes and replacing the rocks, etc.

Aquarium observations may reveal how a clam, if placed on loose sand or fine gravel, burrows into the bottom. Students may wish to discuss and speculate as to how an oyster can make a pearl from a grain of sand.

If you have both clams (or oysters) and starfish in your marine aquarium, it is quite likely that over a period of time a clam (or oyster) will be eaten by a starfish. If so, the students should try to observe how the starfish is able to open the shell of the clam or oyster by wearing him out to exhaustion.

Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

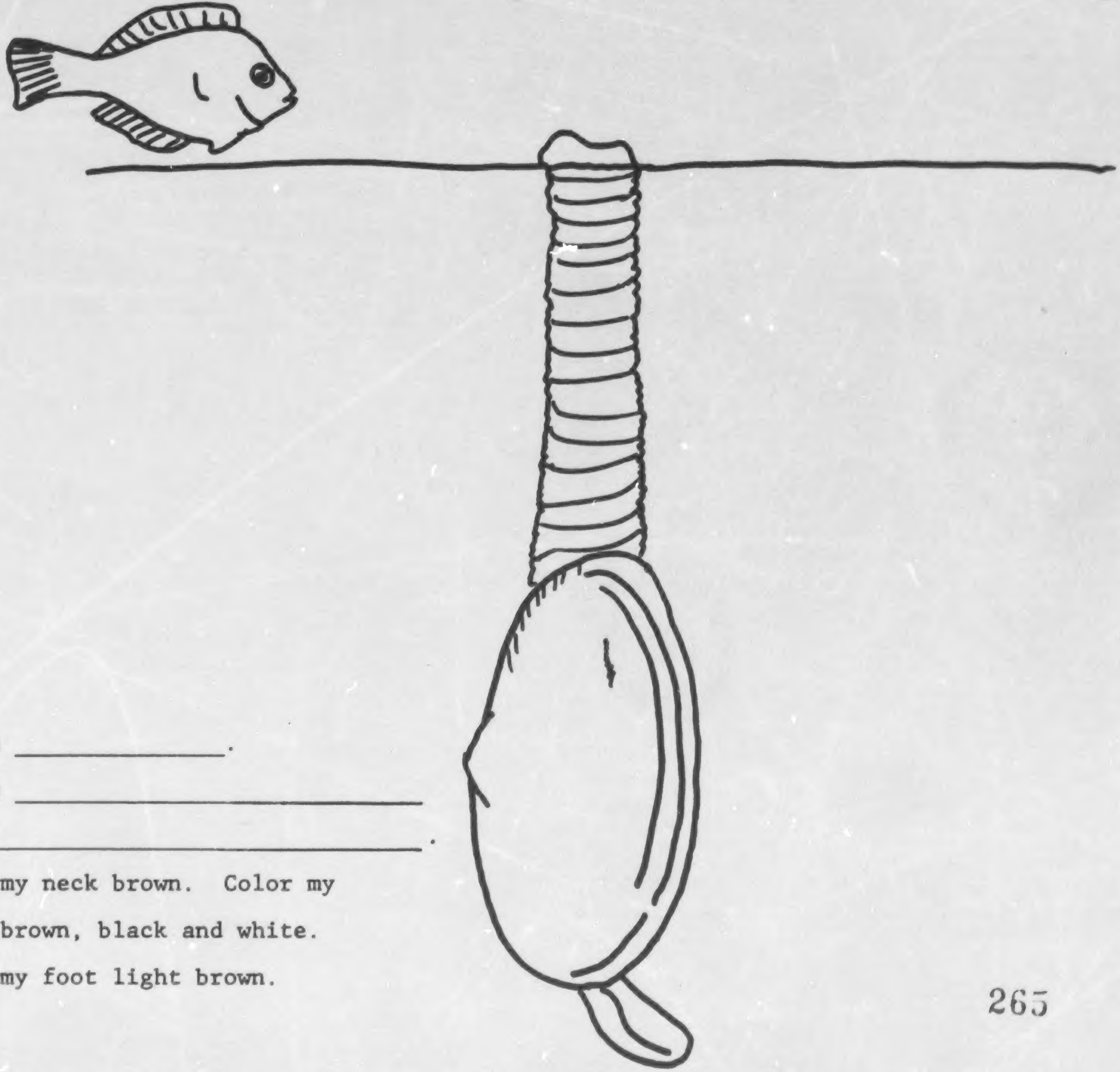
KEY - Text questions

1. A bivalve is an animal with two shells.
2. Oysters may live on top of the sand, on a log, or on a rock (any two).

3. Clams use their foot for moving and for going under the sand.
4. Starfish, oyster drills, moon snails, and people use bivalves for food (any two).
5. Plankton are tiny plants and animals that drift in the sea.
6. Clams and oysters eat plankton.

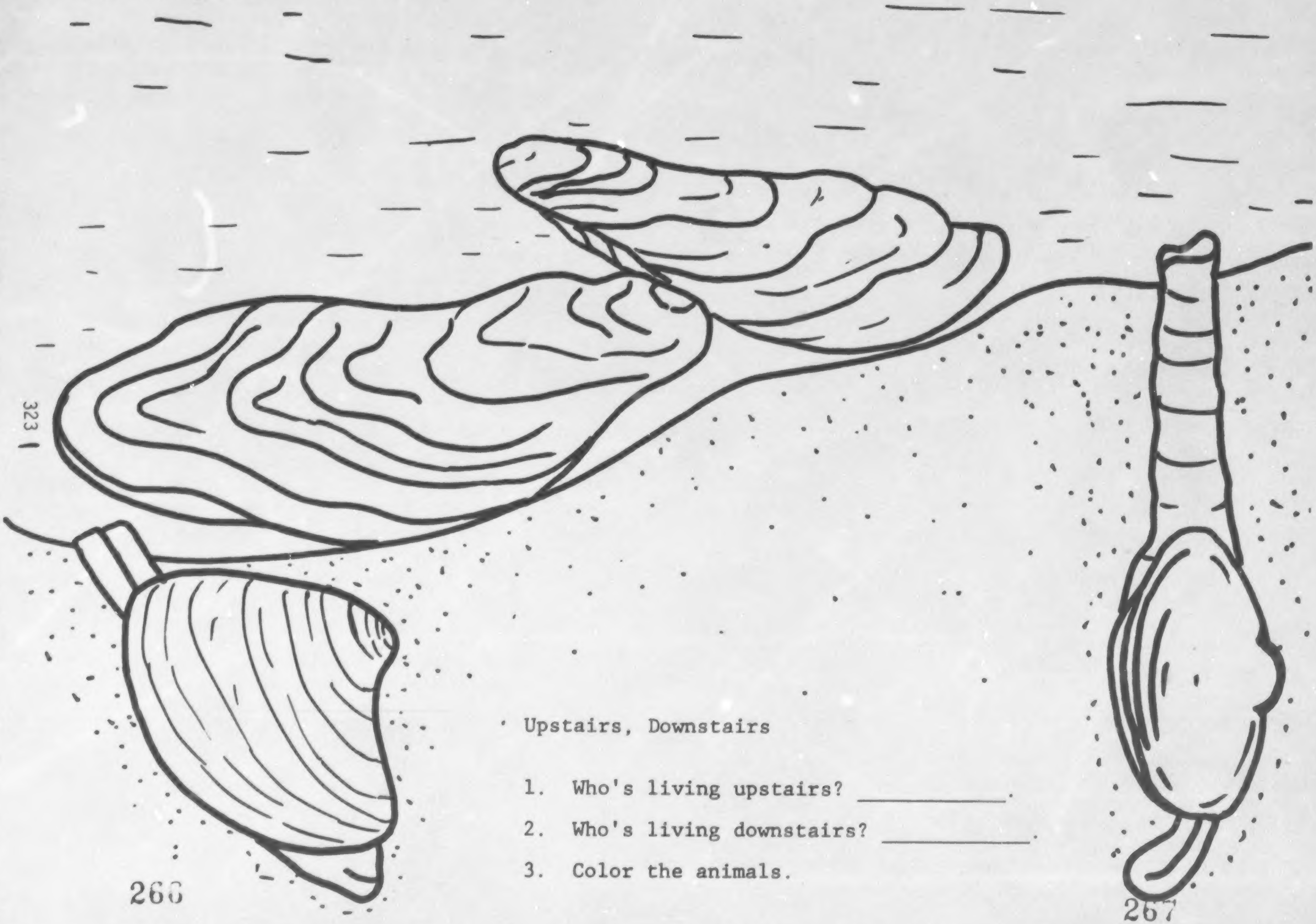
KEY WORDS

bivalves
clam
drifting
enemies
foot
moon snail
oyster
oyster drill
plankton
shell
siphon
starfish
tiny



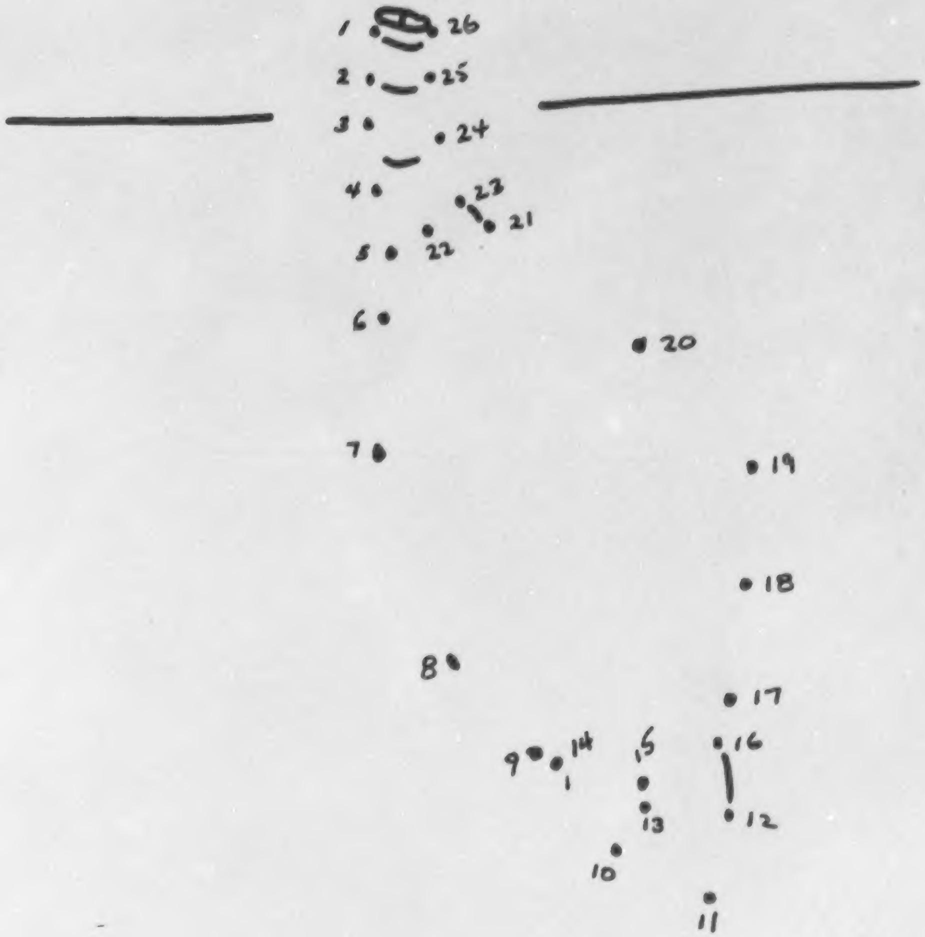
1. I am a _______________.
2. I live ______________________________

   ______________________________________.
3. Color my neck brown. Color my shell brown, black and white. Color my foot light brown.



Upstairs, Downstairs

1. Who's living upstairs? ____________.
2. Who's living downstairs? ____________.
3. Color the animals.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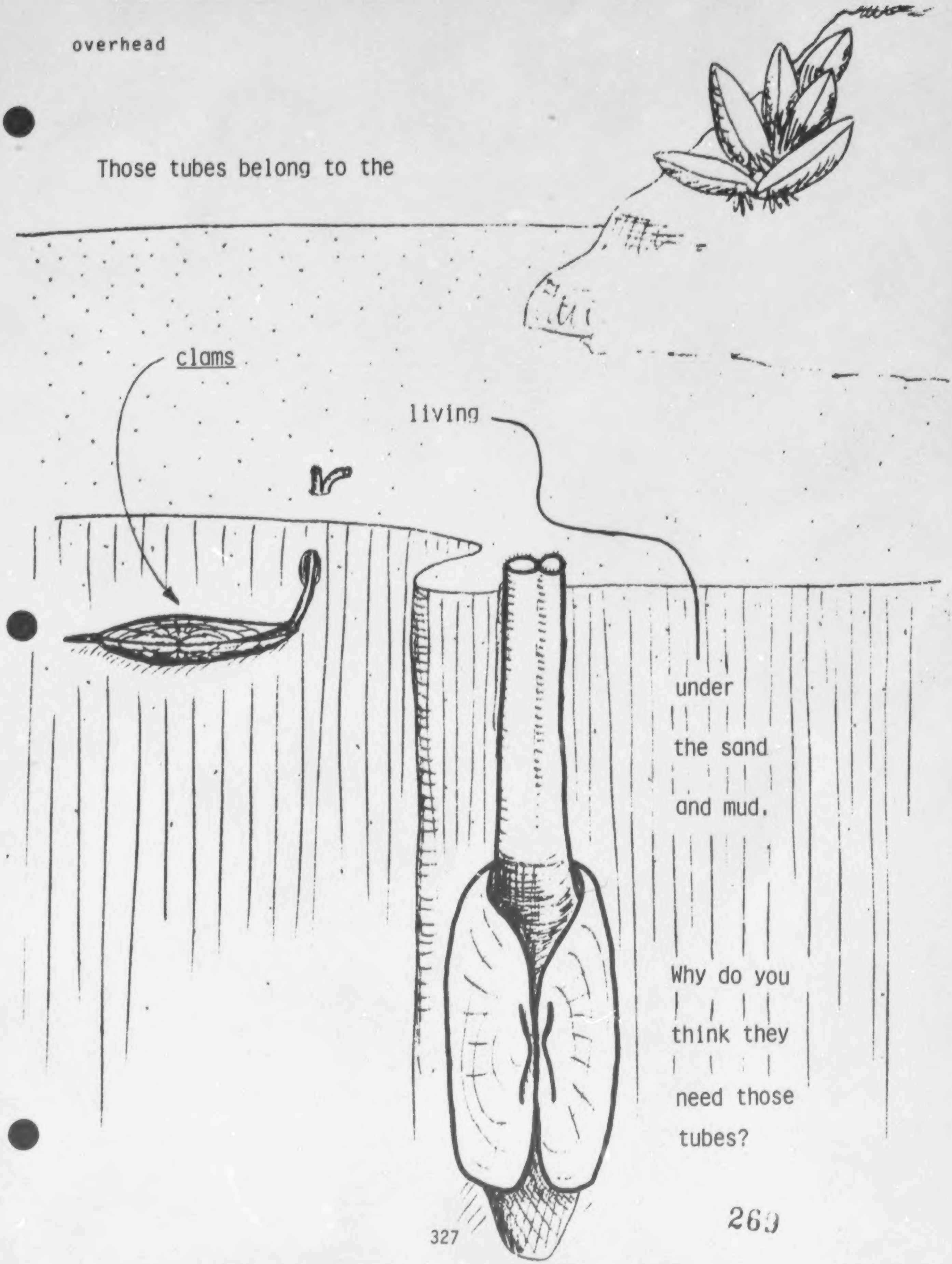
26

I'm hard to catch.

1. I'm a ______________________________.
2. Have you ever eaten me? ___________________________.
3. After you draw me, color me.

overhead

Those tubes belong to the



clams

living

under

the sand

and mud.

Why do you

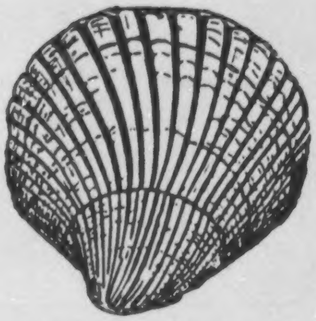
think they

need those

tubes?

Name ______________________

CLAMS AND OYSTERS

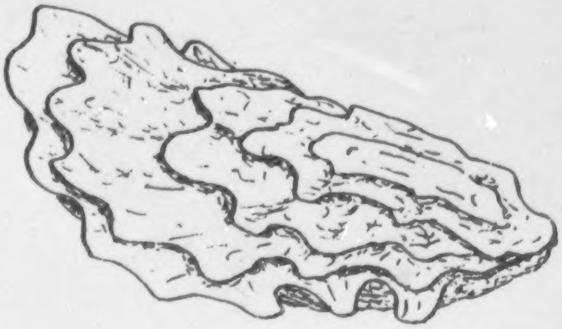

A Cockleshell Clam

Clams and oysters are sea animals. They have 2 shells. They can be called bivalves. Bivalves means "two-shelled".

When clams and oysters are very young they are very tiny. They do not have shells yet. They drift in the sea.

1. What is a bivalve? ______________________________

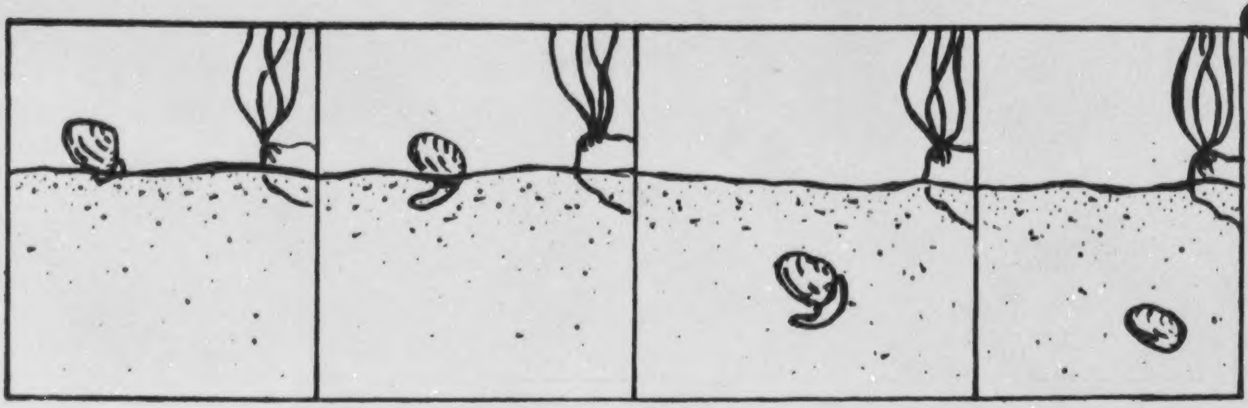
When oysters grow up they like to live on top of the sand. They like to live on something. Sometimes oysters live on a log or on a rock.


Oyster

2. Oysters may live on ______________________________
or ______________________________.

When clams grow up they live in the sand. Clams crawl by using their foot. They can use this foot to go under the sand.

Name ______________________________ Page 2

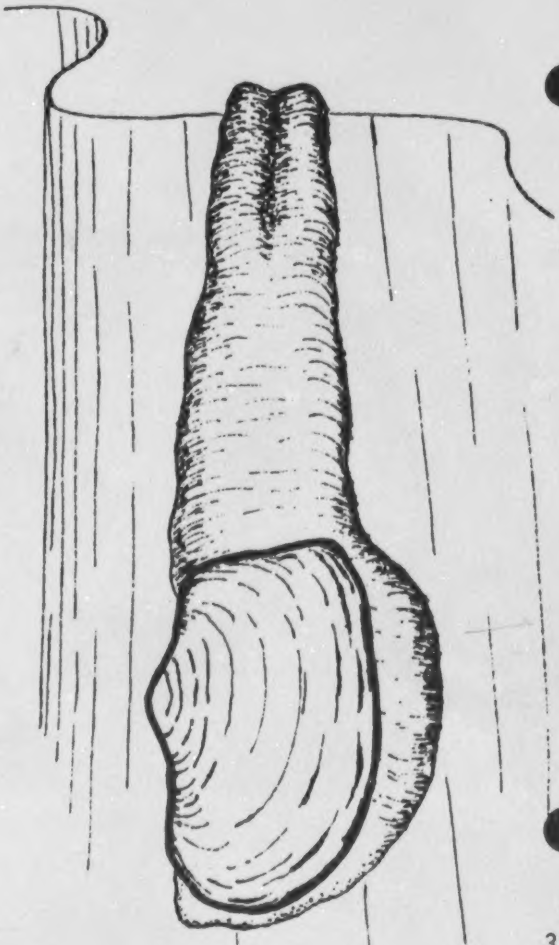


A clam using his foot to go into the sand.

3. Clams use their foot for ____

and ____.

The bivalves have enemies. They are the starfish, the oyster drill, the moon snail and people. These enemies use the bivalves for food.



4. ____________________________

and ____________________________

use the bivalve for food.

Clams and oysters eat little animals and plants that drift in the water. You cannot see these plants and animals unless you look closely. These drifting plants and animals are called plankton.

5. What are plankton? ______

____

____

271 ____________________________

A clam with its siphon extended

Clams and oysters use their siphons to suck the water into their bodies. They eat the plankton in the water and spit the water out.

6. What do clams and oysters eat? ______________________________

____

TEACHER BACKGROUND - Charlie Clam

This exercise helps reinforce some of the material in the text sections. It also gives the student practice in a skill necessary for reading proficiency-the use of context clues.

Duplicate the exercise pages. One copy per student is recommended. This activity may be done individually or in small groups. Alternatively, it may be done individually then in small groups. If the activity seems to be a bit difficult for your class, you can simplify it by placing the first letter of the answer words on the appropriate lines. The "Key Words" should be taught if they are unfamiliar to the students. The second part of the exercise lets your students illustrate the story they just completed. You may find it easier to provide larger sheets of paper. The idea of drawing a sequence of pictures should not be foreign to anyone who has read a comic strip or a comic book but help any students that seem confused.

KEY

Charlie Clam sat on the sand. He had hurt his foot. He could not dig into the sand.

His friend, Olivia Oyster said "Don't worry". She liked to live on the sand. She was a bivalve (two shells). She could hide from her enemies.

Charlie ate a little plankton. He did not feel better.

A sea star saw Charlie. He liked what he saw. He ate Charley, siphon and all;

MORAL: If you can't dig it, you may be in trouble.

KEY WORDS

bivalve
clam
enemies
foot
friend
moral
oyster
plankton
siphon
starfish

273

Name ______________________________

CHARLIE CLAM

Fill in the blanks to finish the story. Use the words listed. The first one is done for you.

Charlie ___Clam___ sat on the sand. He had hurt his _______________. He could not dig into the sand.

His friend, Olivia _______________ said "Don't worry". She liked to live on the sand. She was a _______________ (two shells). She could hide from her enemies.

Charlie ate a little _______________. He did not feel better.

A sea star saw Charlie. He liked what he saw. He ate Charley _______________ and all;

MORAL: If you can't dig it, you may be in trouble.

WORDS

clam	foot
oyster	plankton
bivalve	siphons

274

CHARLIE CLAM

Draw the story of Charlie and Olivia. Use the boxes below.

1.	2.
3.	4.

275

TEACHER BACKGROUND - Mix and Match

"Mix and Match" is an exercise in classification. Your students will have different ideas about the characteristics to use to separate the shells into two groups. It is important to talk about the characteristics used. The "Best" characteristics to use will be those that can be agreed upon by everone and verified by observation. For example, number of shells. The "Poorest" characteristics are those that are subjective or relative. For example How "Big" is "Big"? The size of a speeding locomotive? Discuss these differences with your class.

Duplicate the activity pages, one set per student is recommended. This activity may be performed independently. The "Key Words" should be taught if they are unfamiliar to the students. If you forsee difficulty, you might elect to have your class work in small groups. Spend a few minutes explaining the format and what is being requested. The shells are to be grouped using the presence or absence of a single characteristic. For example, "These shells all have one shell" vs "These shells all have more than one shell". Devote some time to discussion after your students complete the activity. It is important to emphasize that classification systems are man-made and arbitrary. They are constructed to help us catagorize large groups of similar objects.

KEY

The groups and question answers depend upon the characteristics used to separate the shells. Common characteristics include: Number of shells, shape of shells, ridged versus non-ridged, and spiral versus non-spiral.

KEY WORDS

different

group

least

most

same

shells

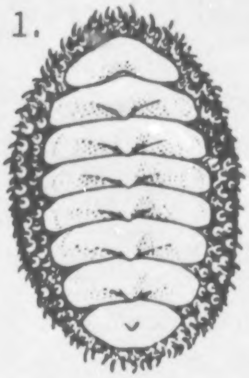
similiar

Name ____________________________ Page 1

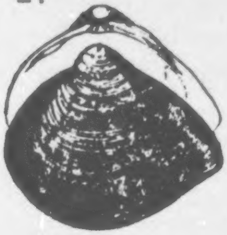
MIX AND MATCH

Look at the five shells. How are they the same? How are they different? Put the shells into two groups. All the shells in a group should be similiar.

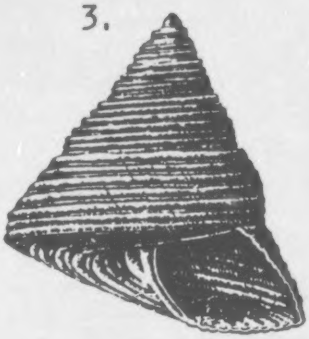
1.



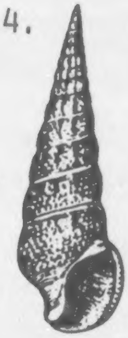
2.



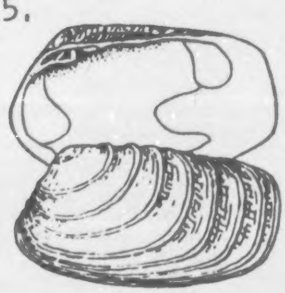
3.



4.



5.



GROUP 1

These shells all
have ________________________
____

Numbers of the shells in
Group 1: _____________________
____

GROUP 2

These shells do not
have ________________________
____

Numbers of the shells in
Group 2: _____________________
____

Which of your groups has the most shells in it? ______________
____

Name ______________________ Page 2

How many shells are in your larger group? ________________

____

Put the shells in your larger group into two smaller groups.

____

GROUP 3	GROUP 4
These shells all have ______________	These shells do not have ______________
______________	______________
Numbers of the shells in Group 3:	Numbers of the shells in Group 4:
______________	______________

Which of your groups has the least shells in it? ____________

____

273

TEACHER BACKGROUND - Home Economics

Not the least interesting thing about clams is their taste. The following receipes are included so that you might share this taste experience with your students. It is possible to prepare the items as a demonstration or to bring the prepared food from home for sharing. The most instructive approach involves student participation.

If you elect to have the students prepare the food, there are some things to keep in mind. Before beginning, read and understand the sequence of steps. Anticipate any problems your particular class might have. Be continually aware of hot items and knives. All of the ingredients may be purchased in most grocery stores. Provide cups and spoons for serving. Serve a small amount to each student, but force no one to eat. Your enthusiastic consumption will do more than requiring them to eat the prepared food.

Most of these items may be prepared in the classroom. All may be prepared on an electric hot plate or conventional stove if you have access to one (cafeteria staff are sometimes quite willing to allow some of their equipment to be used in the afternoon).

Use of canned clams is, of course, possible. If you use fresh clams, it may be wise to pre-cook them and remove and discard soft parts from horse clams after cooking. Bring the pre-cooked clams to class for the students to chop. For clam cooking see "Steamed Clams With Broth".

This is a golden opportunity to expand vocabulary skills and measurement skills. The recipes can be readily metricized. This activity also provides a good exercise in following directions. HAVE FUN!

The first receipe has been presented in a format that you might wish to use if you elect to have the students do the cooking.

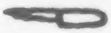
Name ______________________________

DOWN HOME NEW ENGLAND CLAM CHOWDER

A tasty white chowder made from your friend the clam.

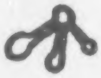
Here are the utensils (tools) you will need:

soup pot
with cover



knife

measuring
cup



measuring
spoons

wooden
spoon

Here are the ingredients you will need:

12 medium size butter or steamer clams chopped
or
4 medium horse clams chopped (chopped: cut into small pieces with a knife)
3 diced bacon strips (dice: to cut into small cubes)
1/2 cup chopped onion
2 1/2 cups diced potatoes
1 1/2 cups hot water
1 teaspoon salt
Dash pepper
2 cups milk
1 tablespoon butter
parsley sprigs

Method:

1. Place the bacon in the soup pot and cook the pieces until crisp.
2. Add the onion to the soup pot. Cook until the onion is tender. The onion will become nearly transparent when it is cooked.
3. Add potatoes, water, salt, pepper and clams.
4. Cover and cook slowly over medium heat for 15 to 20 minutes until potatoes are tender.
5. Blend in milk and butter.
6. Cook until heated.
7. Place in cups and put a small parsley sprig on each cup.
8. Serve and enjoy your homemade chowder!

Makes 12 half cup servings

STEAMED CLAMS WITH BROTH

For six generous servings, use four quarts of fresh clams. Scrub thoroughly in running water to remove sand. Put clams in upper section of a steamer, over two cups cold water in lower section and cover. Cook over low moderate heat steaming until shells open. Serve with individual dishes of melted butter seasoned with lemon juice, salt and pepper. Remove from shells, dip into the melted butter and eat all but the neck or siphon. Allow liquid to settle and serve broth either hot or cold with crisp crackers.

FRITTERS

Heat fat in deep kettle until a cube of bread browns in 50 seconds (375°). Cut geoduck neck into individual pieces then dip geoduck clam in fritter batter and immerse in hot fat. Fry quickly until golden brown (3 to 6 minutes) drain on absorbent paper. Serve with lemon and tartar sauce.

FRITTER BATTER

2 eggs, slightly beaten. Stir in 1/2 cup of milk. Sift together and beat in 1 cup flour, 1 tablespoon baking powder, and 1 tablespoon salt. Beat in 1 tablespoon melted fat or cooking oil.

CLAM BISQUE

Mix together and simmer 3 minutes the liquid drained from 7 1/2 to 8 oz of fresh clams (minced).

1 cup water
1 to 2 teaspoons salt
2 teaspoons grated onion
2 teaspoons finely minced parsley
add . . . .
2 cups milk
stir in a paste (roux) of ...
2 tablespoons butter, melted
1 tablespoon flour

Boil one minute stirring continuously, then place over boiling water until time to serve. Before serving stir in the minced clams. Serve garnished with minced parsley.

WHITE CLAM SPAGHETTI SAUCE

4 tablespoons olive oil
4 tablespoons butter
2 cloves garlic
3 tablespoons chopped shallots
2 cups ground or minced clams (butter, razor or geoduck)
1 cup clam jiuce
1/4 cup chopped parsley
1/2 cup Parmesan cheese
1/2 pound linguini spaghetti

Melt butter and oil in frying pan, add undrained ground or minced clams to mixture after sauteing garlic and chalots in butter mixture. Do not substitute onions for chalots. Add clam juice and simmer gently for 20 minutes. Meanwhile cook spaghetti in boiling salted water until done. Drain. Arrange on heated platter. Pour clams over spaghetti. Sprinkly with parsley and parmesan cheese. Serve hot. Makes six servings.

STUFFED BUTTER CLAMS

1 dozen butter clams (3/4" size)
1 medium onion
2 1/2 cups Ritz or soda crackers, about 6 oz.
1 medium green pepper, chopped fine
salt and petter to taste
dash of Worchestershire sauce
butter

Open raw clams, save nectar and shells. Grind alternately clams, crackers, and onion. Add green pepper to mixture. Moisten with nectar until mixture is quite moist. Place mixture in shells and dot with butter. Bake about 20 minutes at 325° until bubbly and golden brown. Makes 24 appetizers or may be used as entree for 4 or 6 persons. Mixture may be made ahead of time and refrigerated. Thsi recipe may be used for razor clams.

KING CLAM FRITTERS

The entire king clam is edible with the favorite portions being the neck (siphon) or breast meat. Immerse the whole clam in very hot water for one to two minutes. The skin will peel off and the shell will open easily. Keep the neck, breast and gonad for use. Mince the king clam.

Mix 1 cup cooked minced king clam; 1/4 cup crisp, crushed bacon bits; 2 tablespoons chopped onions; salt; pepper; and 1/4 cup cracker meal. Shape into 1/2 inch balls. Dip in batter made of 2 eggs, 2 tablespoons flour, 2 teaspoons onion powder, dash of salt. Fry in deep fat at 350° until browned.

KING CLAM SAUTE'ED

Immerse the whole clam in very hot water for one to two minutes. The skin will peel off and the shell will open easily. Keep the neck, breast and gonad for use. The thinner, upper two-thirds of the neck is best ground for showder. The thicker base of the neck, breast and gonad can be sliced about a half-inch thick and saute'ed.

Dip king clam steaks in seasoned flour, then dip into beaten raw egg. Saute' in hot 400° oil for about one minute on each side. Serve with lemon wedges and garnish with parsley. Cooking time may be slightly longer for breast and gonad cuts.

BROILED KING CLAM

Immerse the whole clam in very hot water for one to two minutes. The skin will peel off and the shell will open easily. Keep the neck, breast and gonad for use. The thinner, upper two-thirds of the neck is best ground for chowder. The thicker base of the neck, breast and gonad can be sliced about a half-inch thick. The neck section can be pounded with a mallet to tenderize it. (first slit it open to wash out the sand)

Pan broil the steaks for two minutes. Turn them over and coat with mayonnaise. Broil six more minutes and serve.

GEODUCK STEAKS

The goeduck should be thoroughly washed, removed from the shell and the neck (or siphon) cut from the body. This is the choice part and generally the only part eaten. although virtually all of the clam is edible.

Quickly blanch the neck and body portions in boiling water so that it may be skinned easily. After skinning, rinse in cold water.

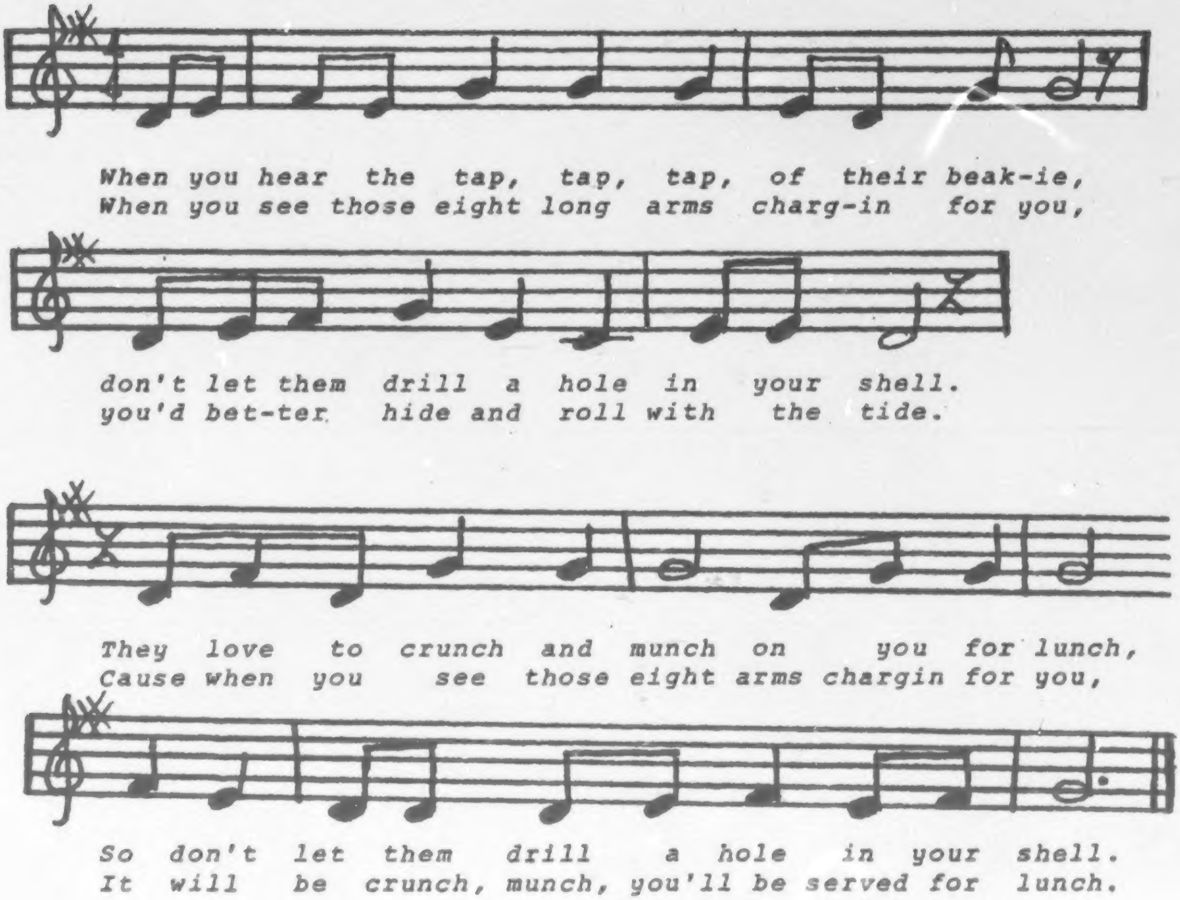
Cut neck lengthwise halfway through. Lay neck flat and cut into six pieces (depending on its size.) With a meat mallet pound on both sides of neck pieces until thin, but not so much that the meat is cut through. Beat two eggs and half a cup of milk mixing well. Roll geoduck steaks in cracker meal, then dip in the egg mixture and roll again in cracker meal. Chill well.

Put about one half inch of oil in a heavy skillet. Heat to about 400°. Fry steak about one minute on each side. Be careful not to overcook. Body portions can be cooked in the same way.

CLAM CHOWDER

Place 2 cups chopped clams in about 2 inches of water in a dutch oven and boil for 15 minutes. Add 1 onion, chopped; 2 or 3 ribs of celery, chopped; and 2 potatoes. Combine vegetables and clams. Add enough water to cover (3-4 cups). Add one can of evaporated milk. Salt and pepper to taste. Thicken with roux. Roux is made from flour and oil. Mix until rather stiff. Thicken to taste.

THE HUNGRY OCTOPUS

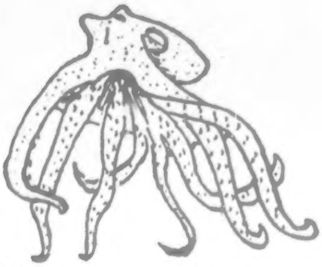


When you hear the tap, tap, tap, of their beak-ie,
When you see those eight long arms charg-in for you,

don't let them drill a hole in your shell.
you'd bet-ter hide and roll with the tide.

They love to crunch and munch on you for lunch,
Cause when you see those eight arms chargin for you,

So don't let them drill a hole in your shell.
It will be crunch, munch, you'll be served for lunch.



OYSTER DRILLS AND MOON SNAILS

TEACHER BACKGROUND - Oyster Drills and Moon Snails

This section deals with two shellfish that are probably unfamiliar to your students. Supplement the text with pictures and shells. Stress the interrelationships that exist between marine organisms as you discuss this section. This section provides an opportunity to make the point that it is dangerous to label one animal or plant as "Good" and another as "Bad". Each organism fulfills a special role, they are all important. Mankind is diminished if any organism becomes extinct. Mankind also reduces its chances of survival by eliminating other species. We just do not know the totality of the interrelationships that exist. What seems unimportant often turns out to be vital.

The oyster drill and the moon snail are two of the bivalve's natural enemies. Although the oyster drill or whelk and moon snails are hated by the oyster growers, the students should be made aware of the fact that even these animals have their place as a necessary part of the whole system.

Of these two univalves, the moon snail is probably the most unusual with its sand collar egg case. The moon snail cements the eggs together with particles of sand, in the form of a sand collar. She leaves the sand collar on the beach where the eggs hatch in due time.

The students might explore the idea that it takes a lot of work for both the moon snail and oyster drill to get their food.

Drilling through a hard oyster shell is a bit of tough tongue wagging even if one's tongue is rough. This file tongue is called a radula.

Both of these univalves are equipped with a trap door to their shell called an operculum. They use this trap door to seal themselves inside their shells when in danger.

In the marine world, what is an enemy to one animal becomes a delicacy to another. The predator-prey relationship that exists between the oyster drill or moon snail and its prey can provide material for an introduction of food chains and food webs.

Duplicate the text materials. One set per student is recommended. Provide your students with the assistance needed to answer the text questions. The "Key Words" should be taught if they are unfamiliar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

KEY = Text questions

Oyster drills or shelks

1. Univalve animals have one shell.
2. Another name for an oyster drill is whelk.

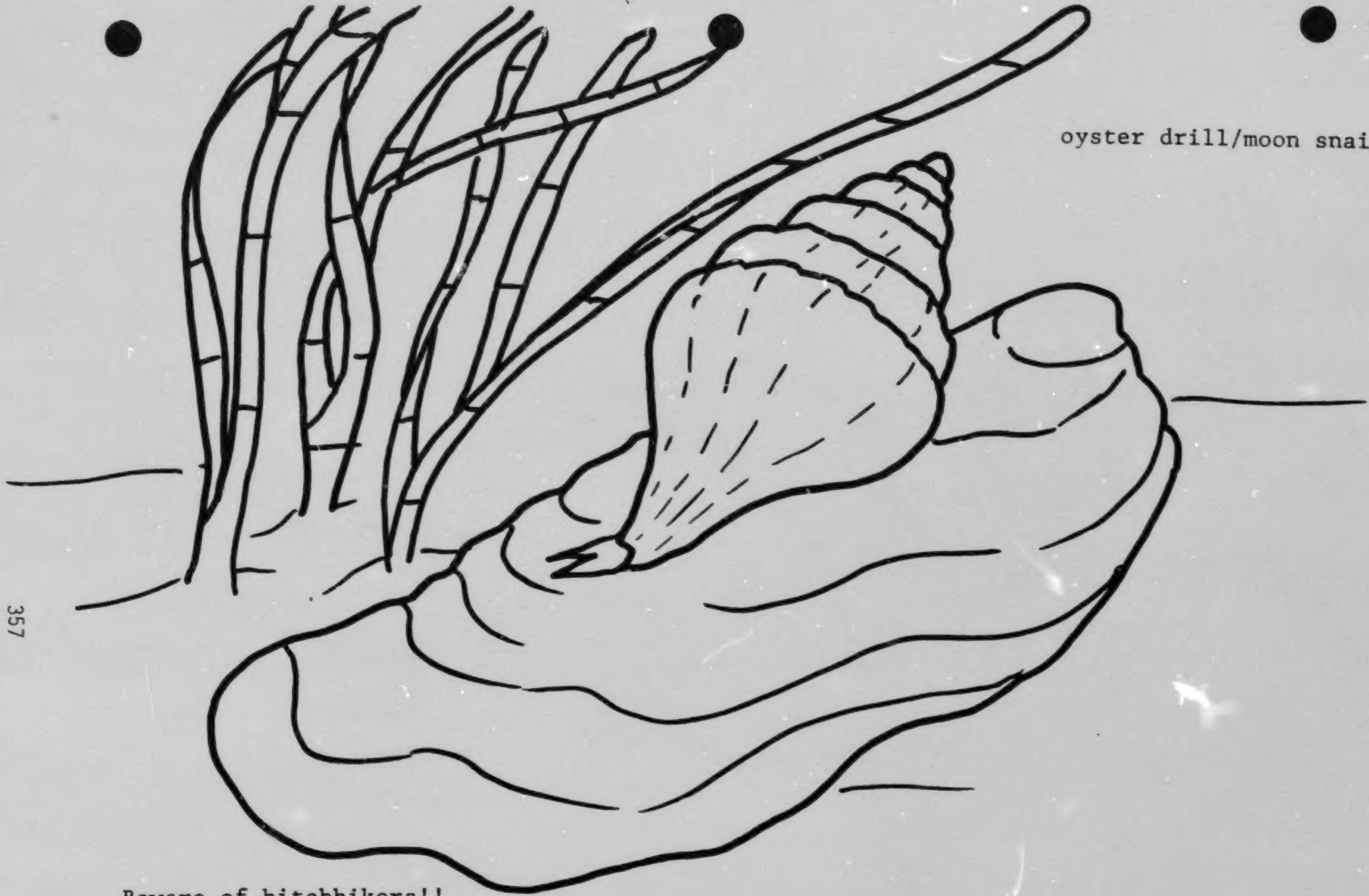
Moon Snail

1. The moonsnail makes its body bigger by filling it with water.
   It is a univalve.
2. Another univalve is the oyster drill or whelk.

3. The moon snail uses her rough tongue to drill holes in shells.
4. The moon snail lays its eggs in the sand collar.
5. Moon snail babies grow up while drifting in the water.

KEY WORDS

clam
drift
drill
eggs
foot
glue
hatch
holes
jelly
moon snail
ocean floor
oyster
oyster drill
sand
sand collar
scrape
shell
sharp
sucks
tongue
univalve
whelk



oyster drill/moon snail

357

Beware of hitchhikers!!

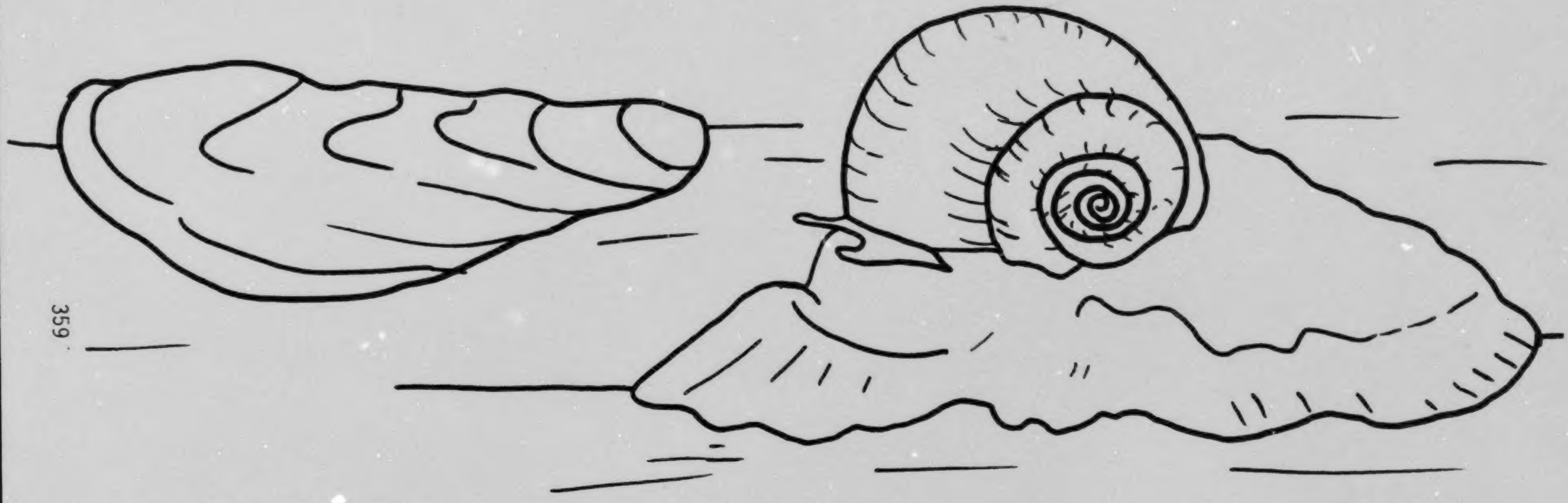
1. Who is the hitchhiker?____________________________________

2. Who is giving him a ride?__________________________________

3. Will the oyster be sorry?_________Why?______________________

4. Color both animals.

oyster drill/moonsnail

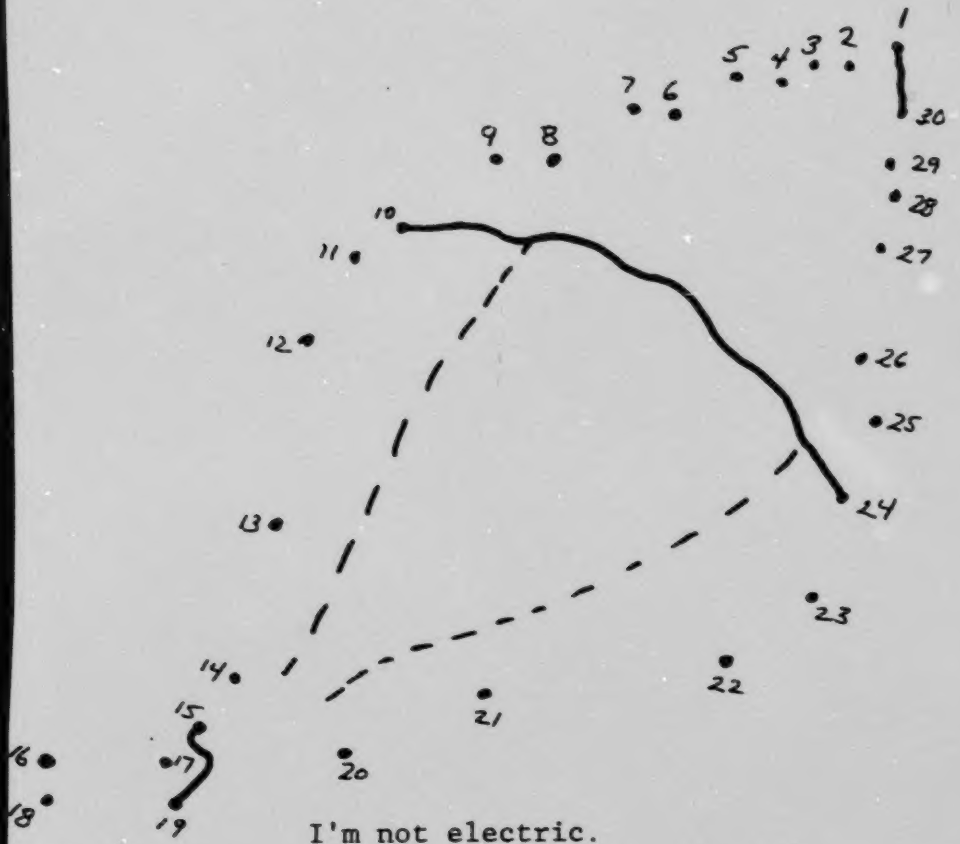


Watch out, Mr. Oyster! Big foot's after you!

1. Who's after Mr. Oyster? ______________________________

2. Why is he after Mr. Oyster? ___________________________

3. Is the oyster safe because of its hard shell? _____________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30

I'm not electric.

1. I'm a ______________________________.

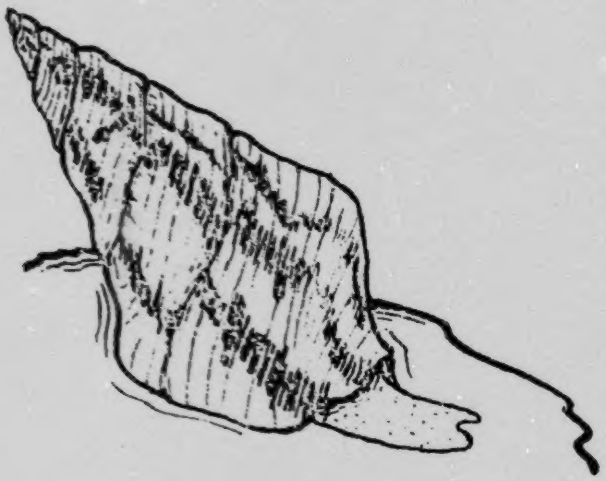
2. I eat ______________________________.

3. I have ______________ shells.

4. Color me.

Name ______________________

OYSTER DRILLS OR WHELKS



A Whelk

This is a whelk. It is also called an oyster drill. A whelk is a univalve. Univalve means "one-shelled".

1. How many shells do univalve animals have? ______

____

The whelk drills a hole in the shell of clams and oysters. It sucks out the animal and eats it. Because a whelk drills holes in oysters, we sometimes call it an oyster drill.

2. What is another name for an oyster drill? ______________

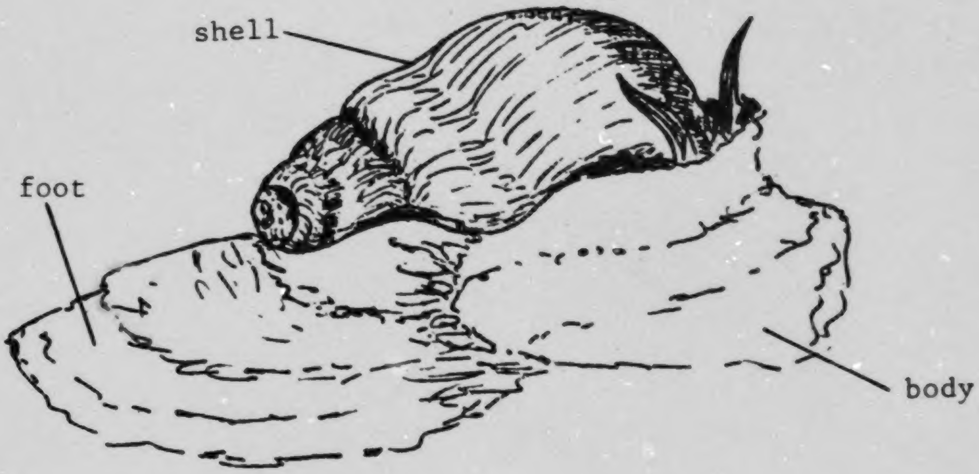
____

____

Name ______________________________ Page 1

MOON SNAIL

The moon snail is an unusual univalve. The moon snail can make her body grow. She can make it grow three times bigger than her shell. She makes it grow by filling it with water.



Moon Snail

The moon snail can move on the ocean floor. It can also move under the sand.

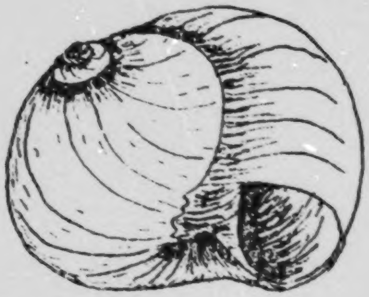
1. How does the moon snail make its body bigger? ____

Name ____________________

2. A moon snail has one shell. It is a ____________________.

Another univalve is the ______________________________.

The moon snail eats clams and oysters. She puts her foot around the clam. She drills a hole in the shell with her rough tongue. The tongue of the moon snail is very sharp and strong. Her tongue scrapes the clam meat into small pieces. She sucks the meat out of the hole.



An empty moon snail shell

3. What does the moon snail use to drill a hole? ____________

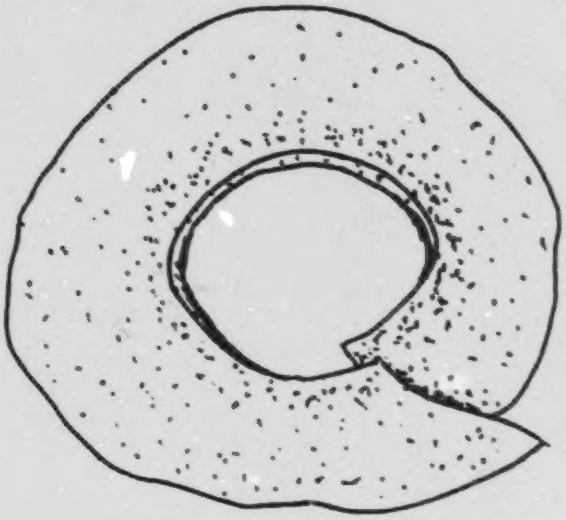
____

____

Name ______________________________

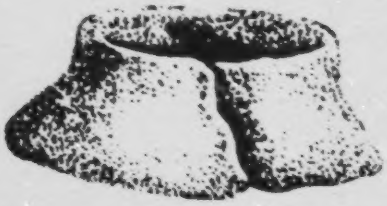
The moon snail's eggs are very small. She lays them in a glue of jelly and sand. This is called a sand collar. On the beach at low tide you can see sand collars. The moon snail lays the eggs in the sand collar and leaves. She never goes back to it.

4. The moon snail lays its eggs in ________
____
____



The Sand Collar

When the eggs hatch, they leave the sand collar. They drift in the water until they grow up.



Another sand collar

5. Until they grow up, moon snail babies ______________________________
____.

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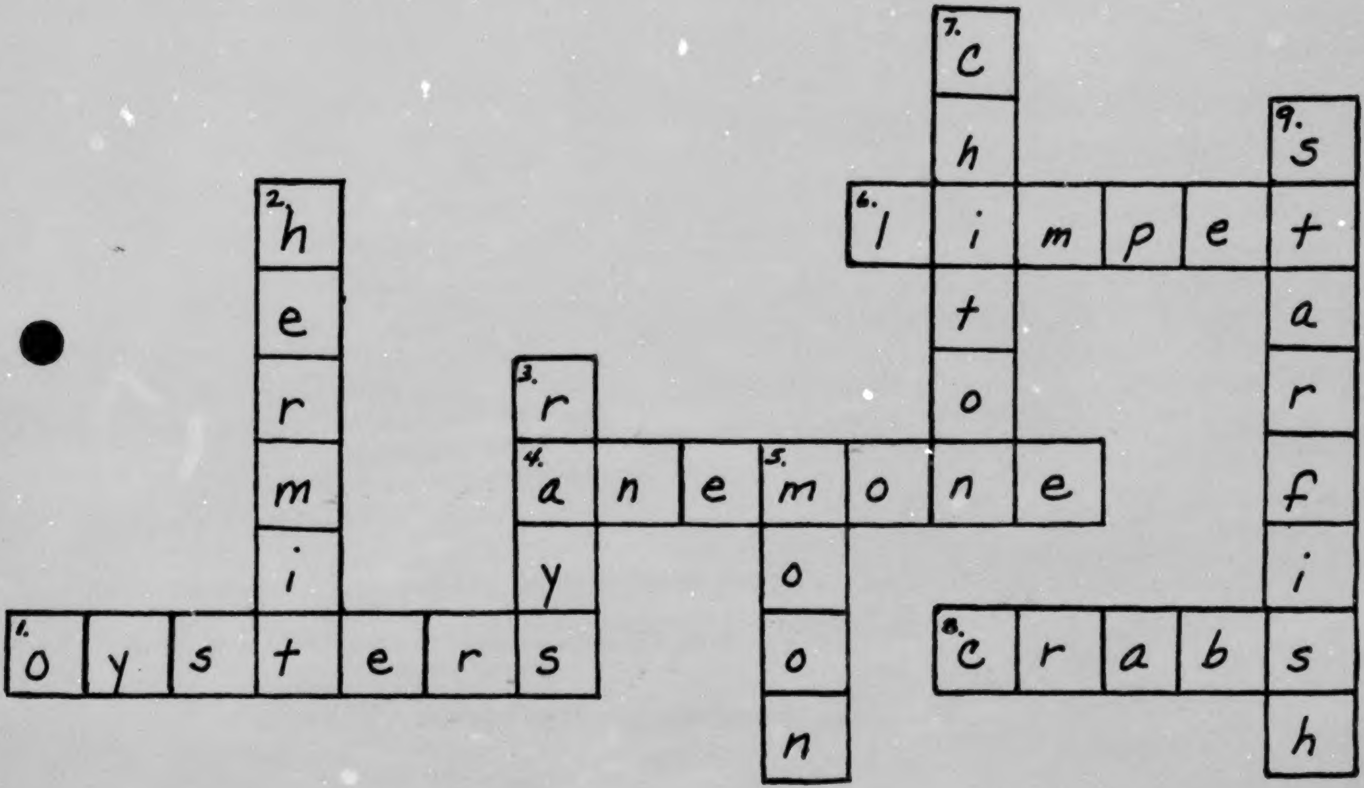
TEACHER BACKGROUND - Critter Cross

This crossword puzzle is designed as a review of the material covered to date. The vocabulary needed is listed on the puzzle page. The vocabulary should be taught if it is unfamiliar to the students.

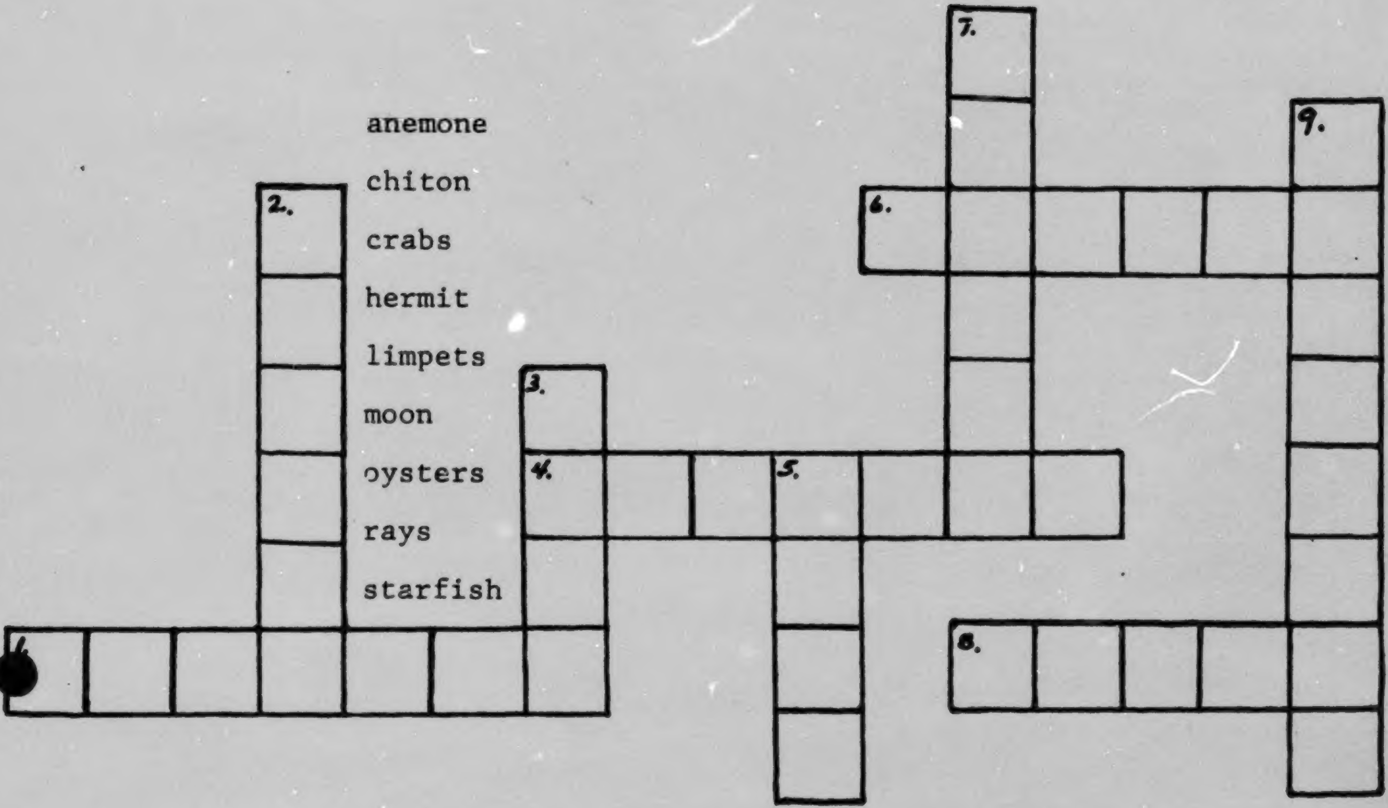
Duplicate the puzzle, one puzzle is recommended per student. Students may work individually or in small groups. Material exchange in small groups is often helpful in this type of vocabulary exercise. Be certain that your students understand how to do a crossword puzzle. Note that this puzzle has a simplified numbering scheme. Provide the assistance necessary to get your class started on this exercise.

KEY


1. oysters
2. hermit
3. rays
4. anemone
5. moon
6. limpet
7. chiton
8. crabs
9. starfish

Name ______________________

CRITTER CROSS



anemone
chiton
crabs
hermit
limpets
moon
oysters
rays
starfish

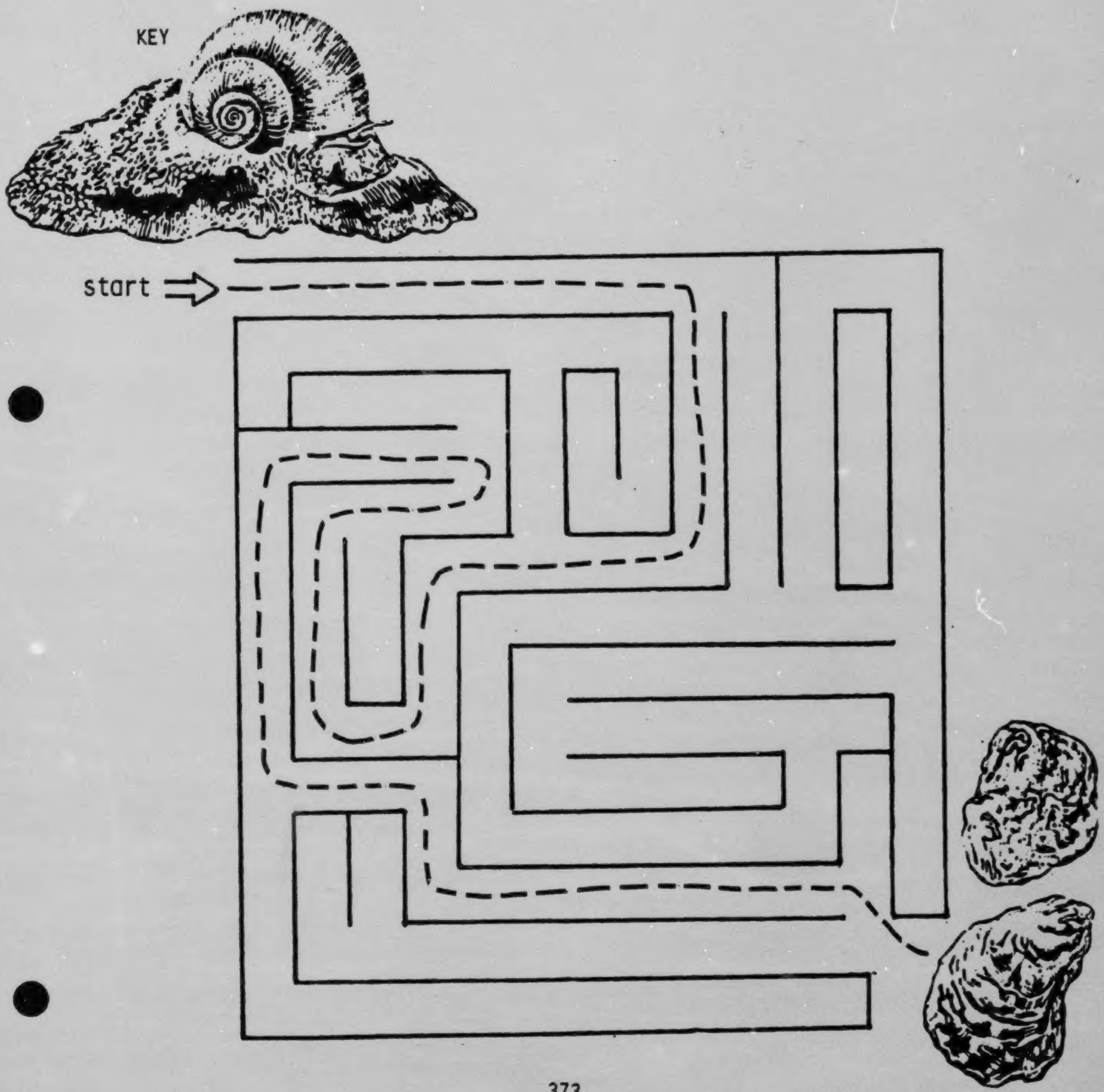
1. Clams and ______________are called bivalves.
2. A ______________crab borrows other sea animals shells.
3. A sea star has arms that are called ______________.
4. A sea ______________pulls its tentacles in when it is afraid.
5. A ______________snail eats clams and oysters.
6. The ______________has a cone shaped shell.
7. A ______________has eight plates.
8. ______________sometimes walk sideways.
9. ______________have tube feet.

TEACHER BACKGROUND - Moonie Maze

"Moonie Maze" is a fun, change of pace activity. The maze can be justified as improving hand to eye coordination and small motor skills. All of this while providing entertainment!

Duplicate one "Moonie Maze" for each student. Students may work individually or in groups at your discretion. Upon completion, provide a few minutes in which to show the correct route.

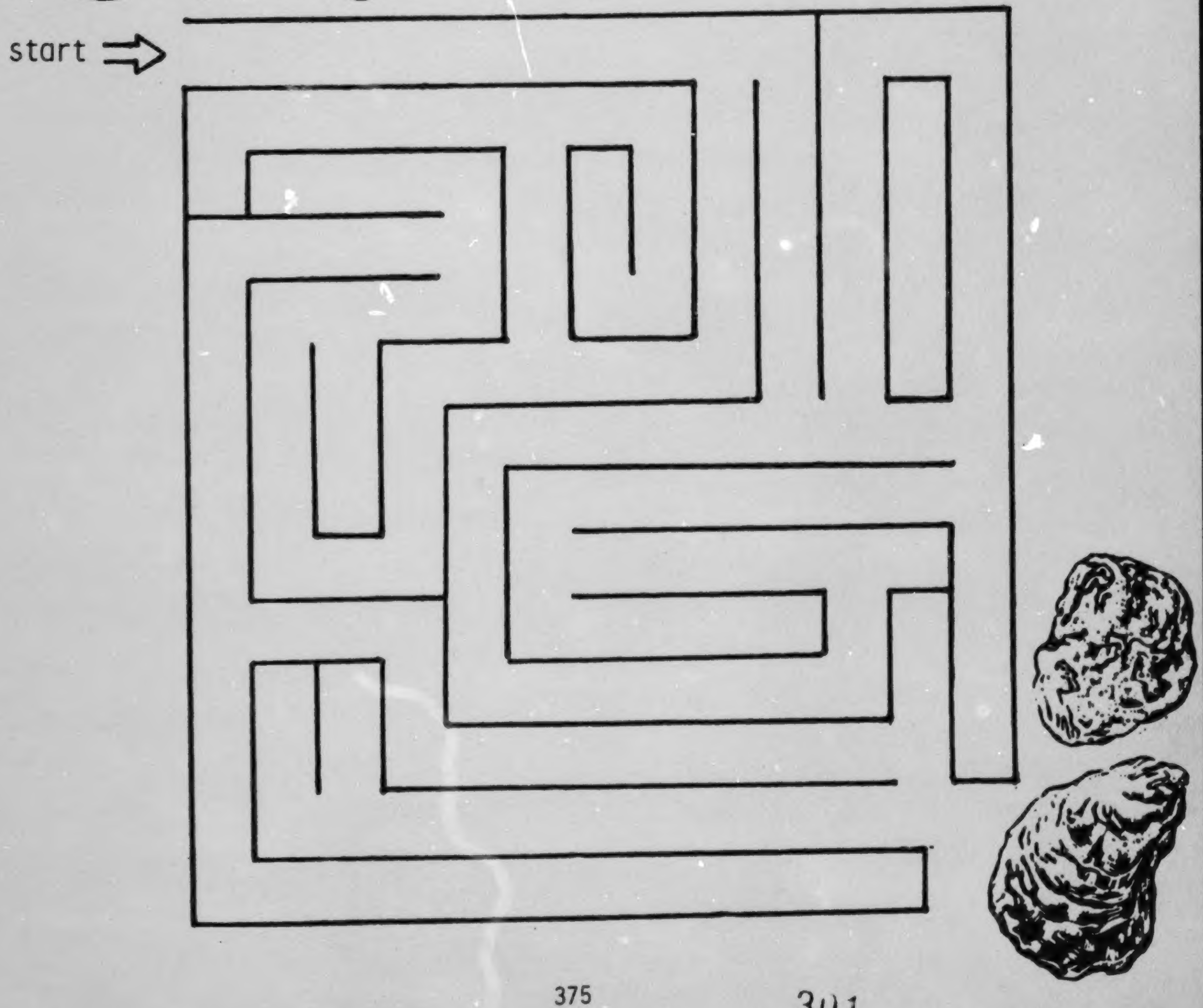
KEY



Name ______________________________

MOONIE MAZE

Milo Moonsnail is looking for dinner. Help Milo find the oysters. Draw a pencil line to show him the way.



TEACHER BACKGROUND - Fishkeeper

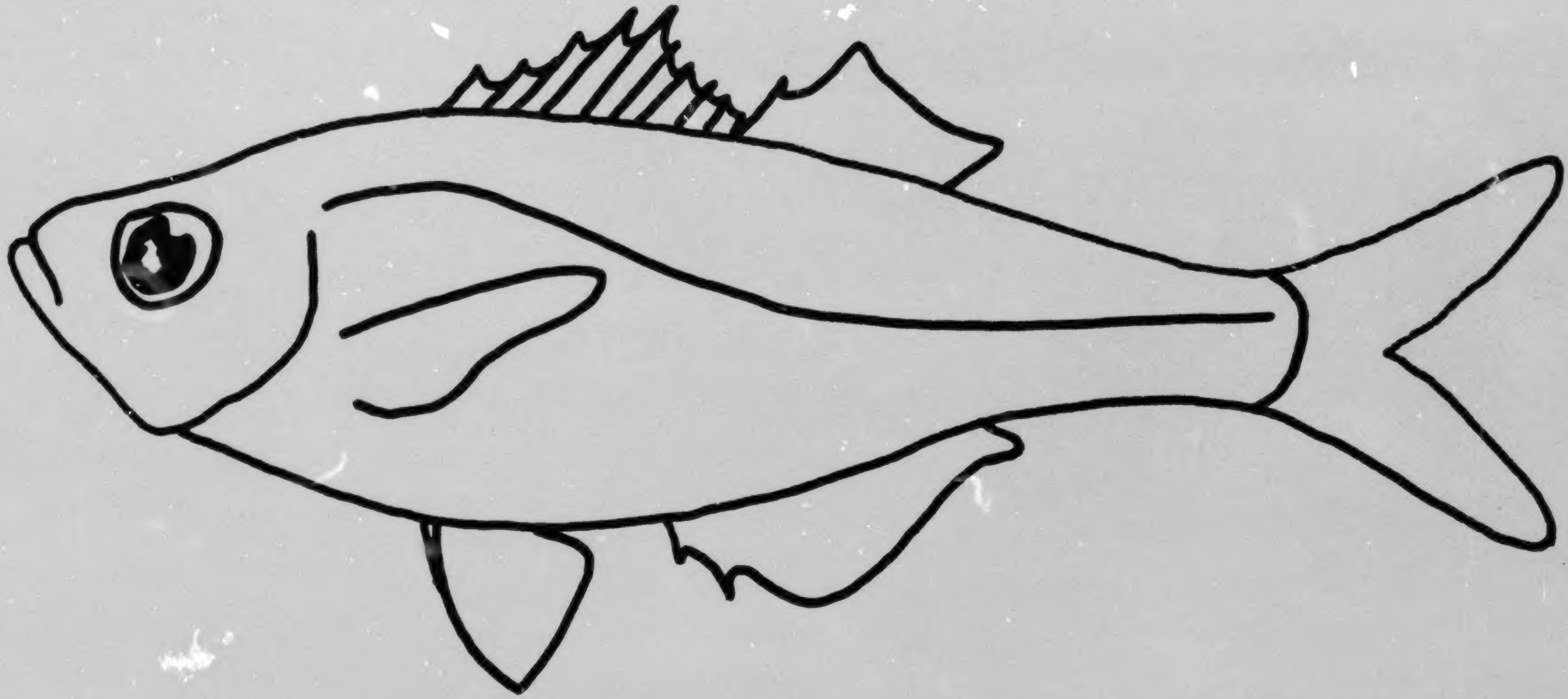
"Fish Keeper" is a large scale board game that provides practice in categorization and classification.

DIRECTIONS:

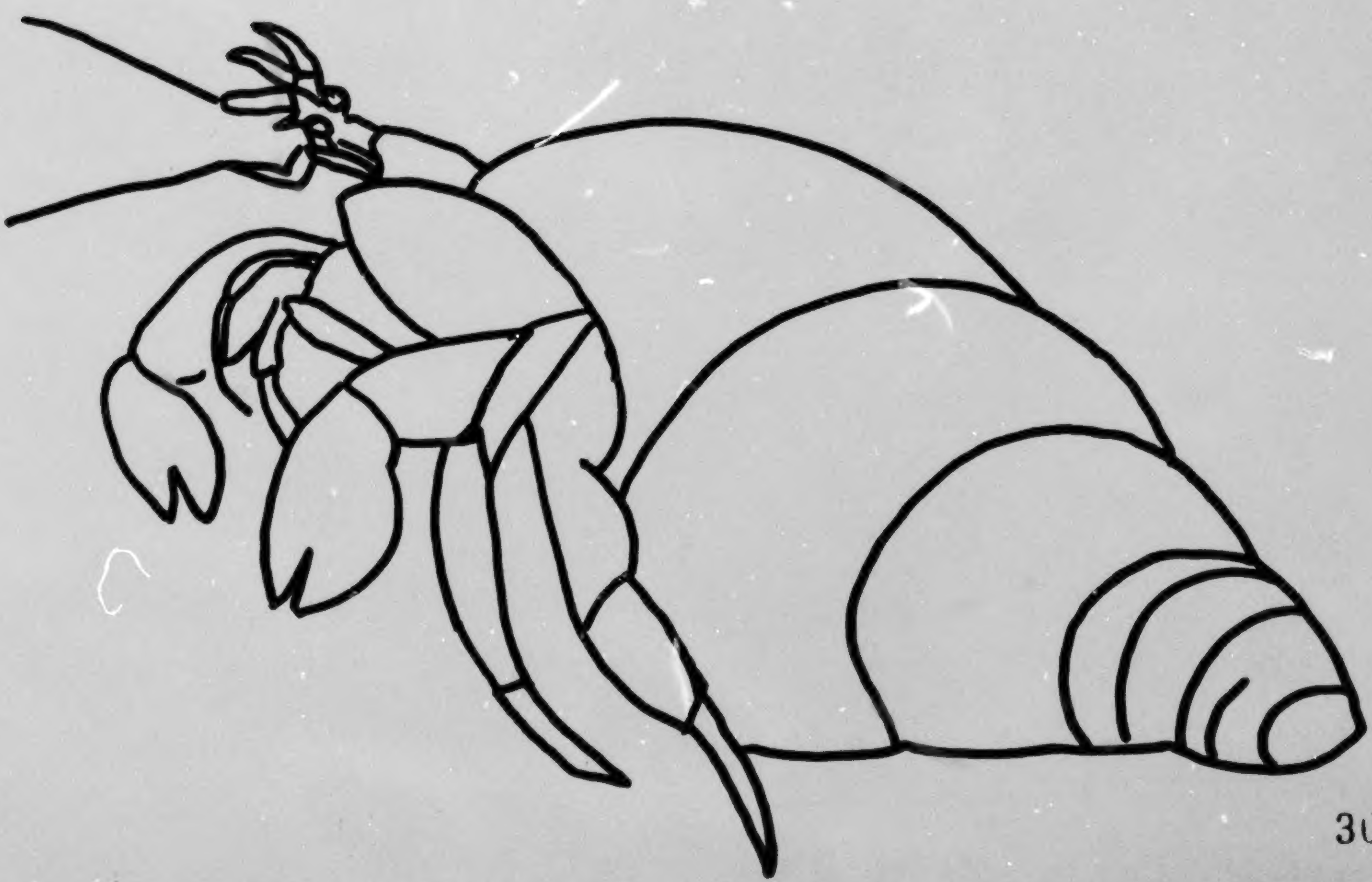
1. Duplicate five sets of the five animal cards which follow. Four of these sets will become the game board. For durability you may want to cover these sets with clear contact paper.
2. The fifth set will become piece cards. Cut each of the five animal cards into four pieces. If you cut them into jigsaw puzzle type pieces you can use the cards later for additional games.
3. Choose one person as the fishkeeper. Divide the remainder of the class into two teams. The teams are the fishers. Move to an open area in the classroom or into the gym or a similar space that will allow both teams to view the game as it progresses.
4. The fishkeeper shuffles the 20 animal cards. He then lays them face up on the floor in a path. He adds the "start" and the "finish" cards. This path will be the game board.
5. Next, the fishkeeper shuffles the 20 piece cards. Without looking at the cards, he hands the first piece to the first fisher from Team A. By tossing a coin, rolling a die, etc. you can determine which team will play first.
6. Fisher one must match the piece card with the first animal card it matches on the game board. The fisher moves his body to correct card and stands on the card. He returns the piece card to the fishkeeper who puts the card on the bottom of the pile.
7. Fishers may land on occupied cards. If a fisher makes a mistake, he must go back to his last place.
8. The fishkeeper gives the next piece card to the first fisher from Team B. The fisher must match the piece card with the first animal card it matches on the game board. The fisher moves his body to the correct card and stands on the card. He returns the piece card to the fishkeeper who puts the card on the bottom of the pile.
9. The game progresses by alternating turns between Team A and Team B.. The first team to reach the end of the path wins.
10. For a longer game, have the fishers move to the closest correct animal card whether it is ahead or behind them.

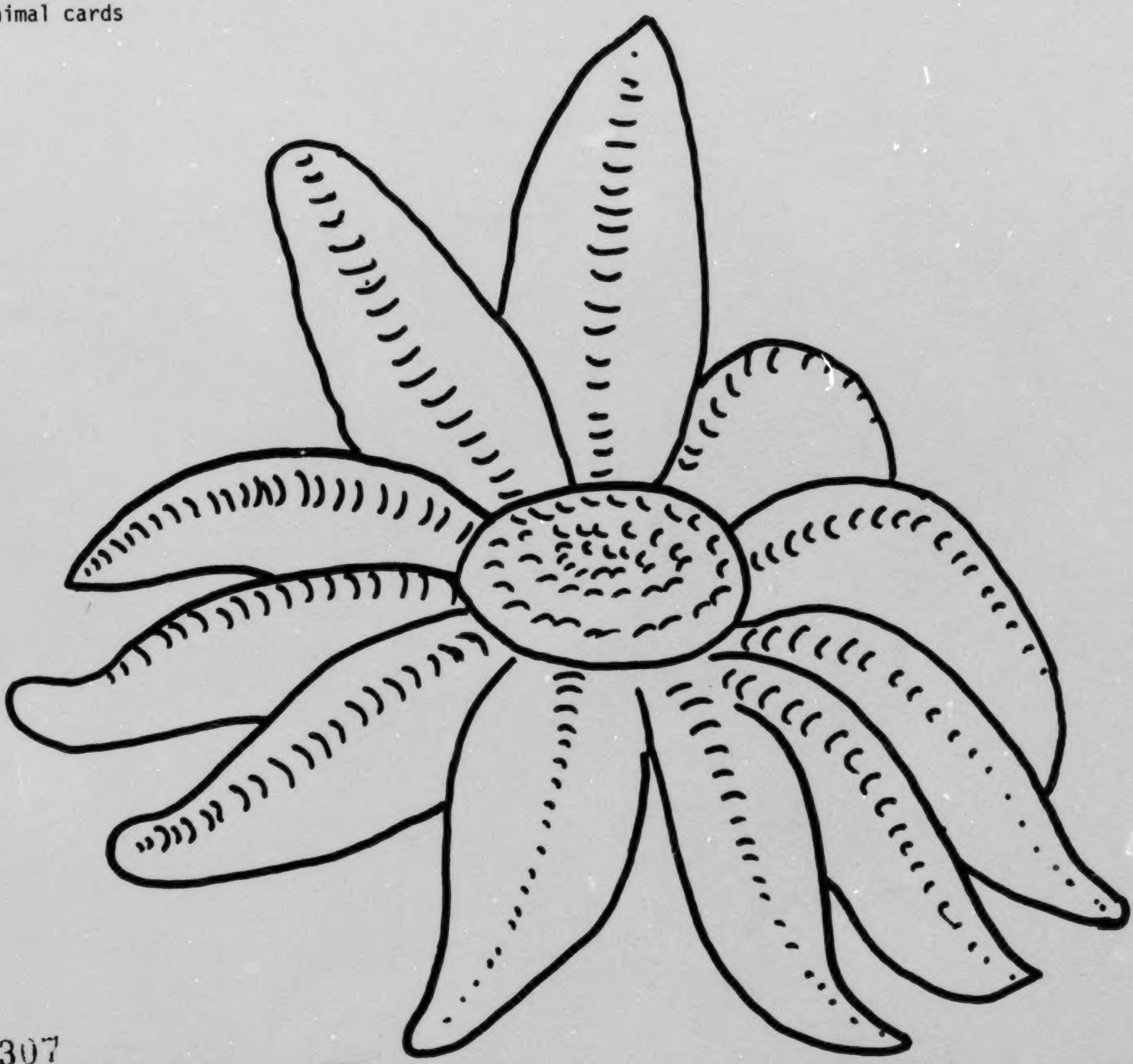
ADDITIONAL USES OF THE ANIMAL CARDS

1. Play concentration with the animal cards.
2. Have students sharpen classification skills by sorting the cards in different ways.

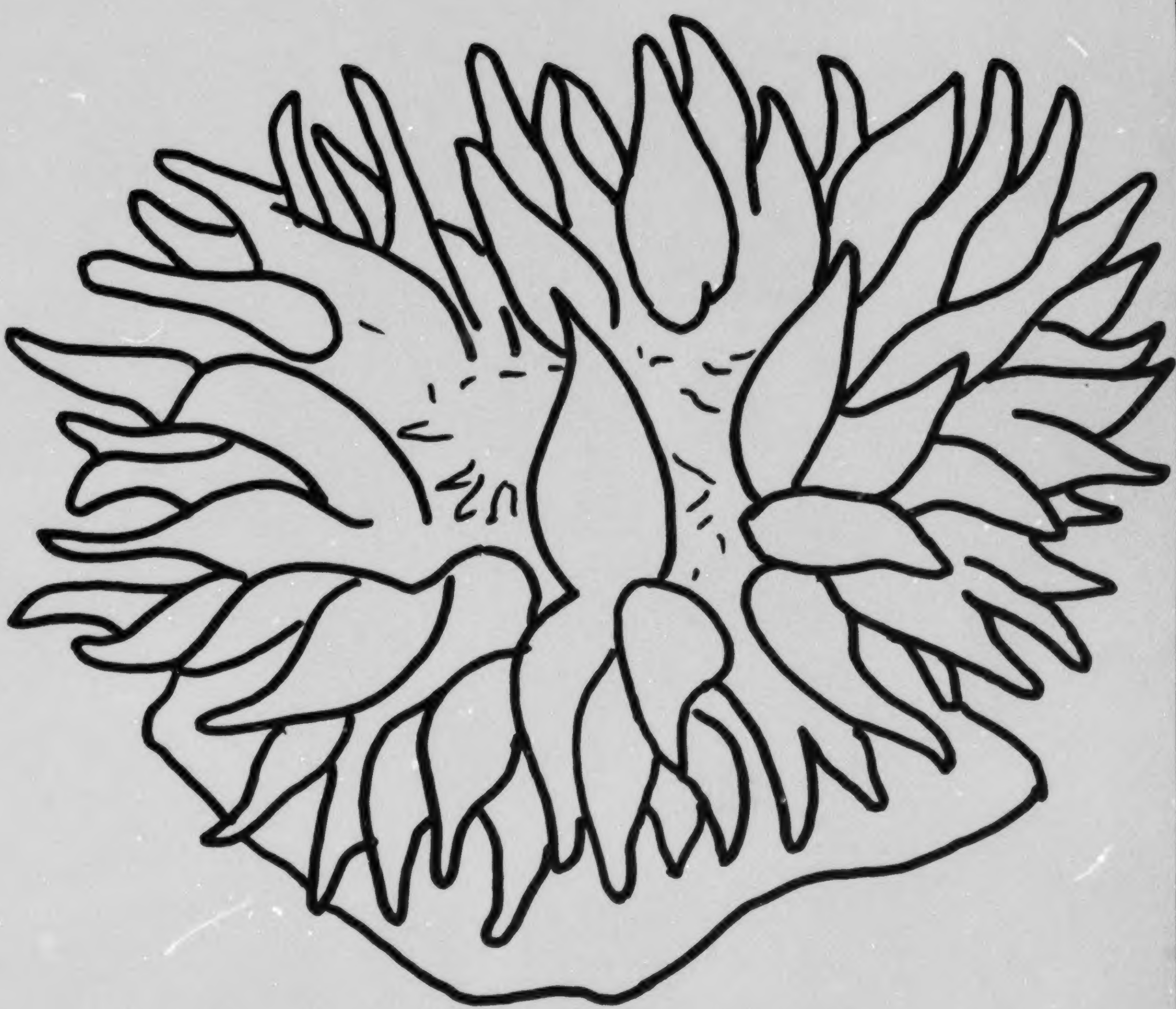


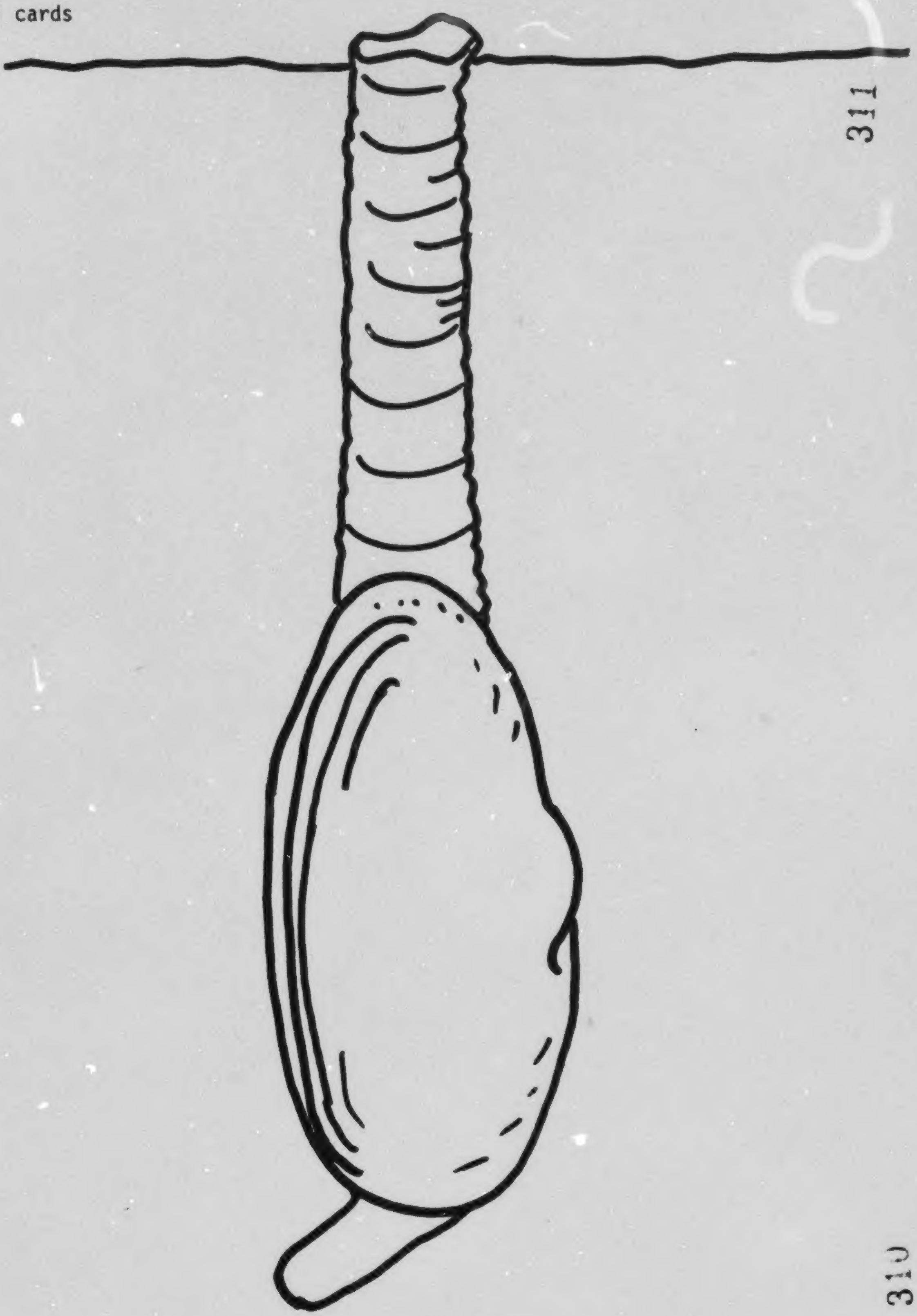
animal cards





animal cards





TEACHER BACKGROUND - Flingo

"Flingo" is an active body movement game designed to build vocabulary and classification skills simultaneously.

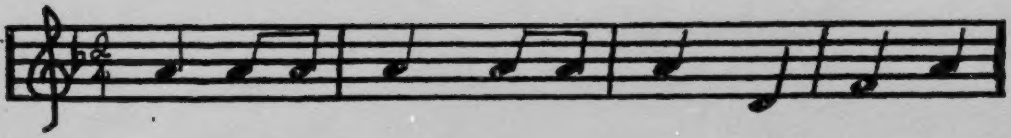
Directions:

1. Obtain the piece cards from the game "Fishkeeper". Make word cards on 8½ x 11" cards. The word cards contain one printed word that in some way relates to the piece cards.
2. Divide the class into two teams. Use a coin or a die to choose which team will be first.
3. Spread the piece cards on the floor in a Bingo like grid. You may elect to have a student do this and to keep score.
4. Shuffle the word cards. Take the top card in turn, all word cards will be placed on top of this card. The first player from Team A stands on the word card. Successful accomplishment gets three points. If only one hand covers a word before the player falls, two points are earned. If the only correct move before falling is standing on the word card, one point is earned. The score is recorded on the blackboard under the heading "Team A".
5. The next word card goes to the first player from Team B. Play continues by alternating turns until each child has had one turn.
6. The winning team is the one with the most points when game is over.

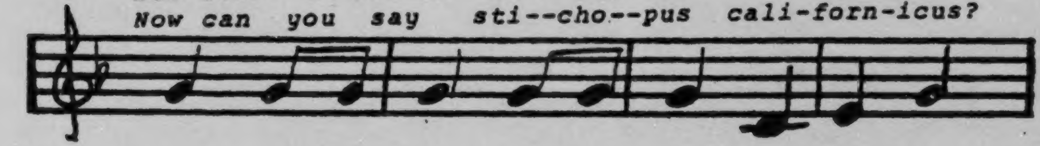
Modifications:

1. Use sets of one picture and two words.
2. Use sets of all words that are related. In this case, the words do not necessarily have to be parts of animals.

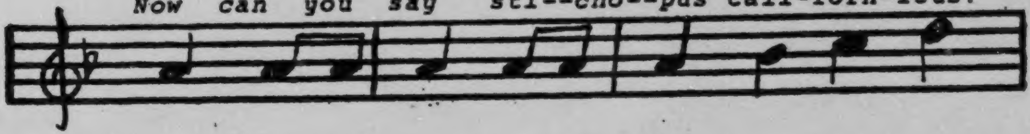
LIVING IN THE OCEAN



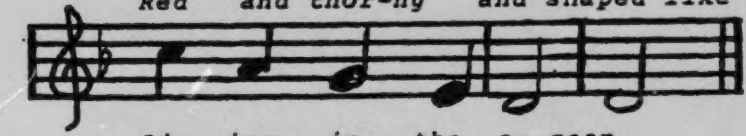
How do you walk like a great sea ur-chin?
How do you greet a hun-gry oct-o-pus?
How does a hermit crab shop for a new house?
Now can you say sti--cho--pus cali-forn-icus?



How do you walk like a great sea ur-chin?
How do you greet a hun-gry oct--o--pus?
How does a hermit crab shop for a new house?
Now can you say sti--cho--pus cali-forn-icus?



Take spin-y steps as you munch on sea-weed,
Eight hands to shake may seem quie-t dang-erous,
Quick, or he's caught by a hun-gry neigh-bor,
Red and thor-ny and shaped like a pick-le,



Liv--ing in the o--cean.
Now you are his sup-per.
Shop-ping in your birth-day suit...SHAME!
Just watch him when he's crank-y...YUK!

SEAWEEDS

314

TEACHER BACKGROUND - Seaweeds

"Seaweeds" focuses on the plant kingdom and its role in the marine environment. Seaweeds and phytoplankton form the basis of all life in the sea. The microscopic phytoplankton are also credited with producing 60 - 80% of the oxygen available to all (land and sea) animals and plants. Many students tend to ignore seaweeds and find them uninteresting. This behavior really stems (sorry) from the fact that they haven't taken the time to look closely at the marine plants. They are diverse and well adapted to life in the sea. To create interest, supply ample visual aids - pictures etc. Dried, pressed specimens can be easily made and will last for years. These specimens can help create interest in marine plants.

Marine plants are known as seaweeds or algae. The seaweeds are just as important for photosynthesis and food to the underwater world as land plants are to the terrestrial world. The seaweeds are usually grouped into four categories: greens, browns, reds and blue-greens. The blue-greens are rarely found outside of tropical waters.

Because all algae need sunlight to conduct photosynthesis, they are restricted to rather shallow depths. In Puget Sound, algae rarely exist below a seventy-five to eighty-five foot depth. The red algae usually grow in deep water, while the green algae can be found in shallow water. The brown, which includes the kelp, are found in the middle zone.

Seaweeds are made up of three basic parts: the hold-fast, stipe, and blades. These compare to the parts of land plants. However, the holdfast does not take minerals from the soil as do the roots of land plants.

Its major function is to anchor the seaweed to the bottom. Certain types of seaweeds, such as kelp, have an air sack or bladder which hold the blades up to aid in the process of photosynthesis.

Man makes use of several types of seaweeds. Kelp has been used for a food supplement for humans and animals. It contains iodine, minerals, vitamins, and carbohydrates. Kelp also contains a substance called algin which has the unique property of absorbing large quantities of water. A tablespoon of algin added to a gallon of ice cream prevents the water in the ice cream from forming coarse ice crystals.

Algin also has the ability to suspend, stabilize, and emulsify chemicals. It is used to suspend drugs and antibiotics, and to keep the abrasive in auto polish and pigments in paints in suspension. Algin is used as a creaming, thickening, and stabilizing agent in rubber and textile manufacturing. Algin prevents the dyes used in printing fabric from running like a drop of water.

Studies have shown that some juvenile kelp plants at first visible only through the microscope will grow as much as ten to fifteen feet in six months. Some of the seaweeds are the fastest growing plants in the world.

When harvesting kelp, man needs to remember that the kelp provides food and shelter for large quantities of fish and other marine organisms.

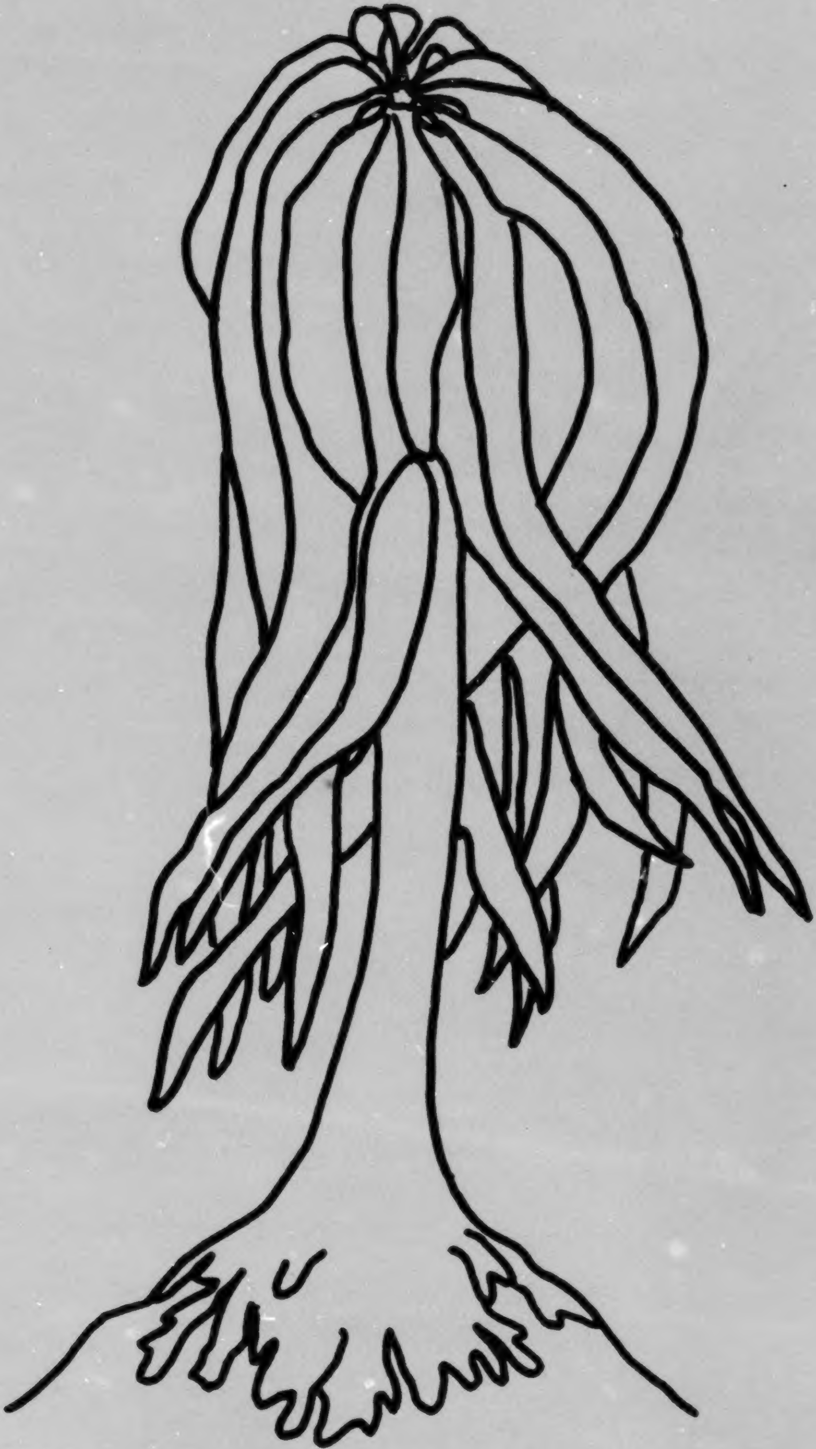
Duplicate the text pages. One set per student is recommended. The "Key Words" should be taught if they are unfamiliar to the students. In teaching this section be sure to emphasize the interrelationships between plants and animals. Discuss what can happen when a member of the food web is removed - especially if that member is a producer. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

KEY - Text questions

1. Plankton are small plants that drift in the sea.
2. The holdfast holds the seaweed on the bottom.
3. The blades are like the leaves of a tree.
4. Seaweeds live on rocks and on shellfish.
5. Many animals eat seaweed.
6. The answer almost certainly should be yes, if for ice cream alone!

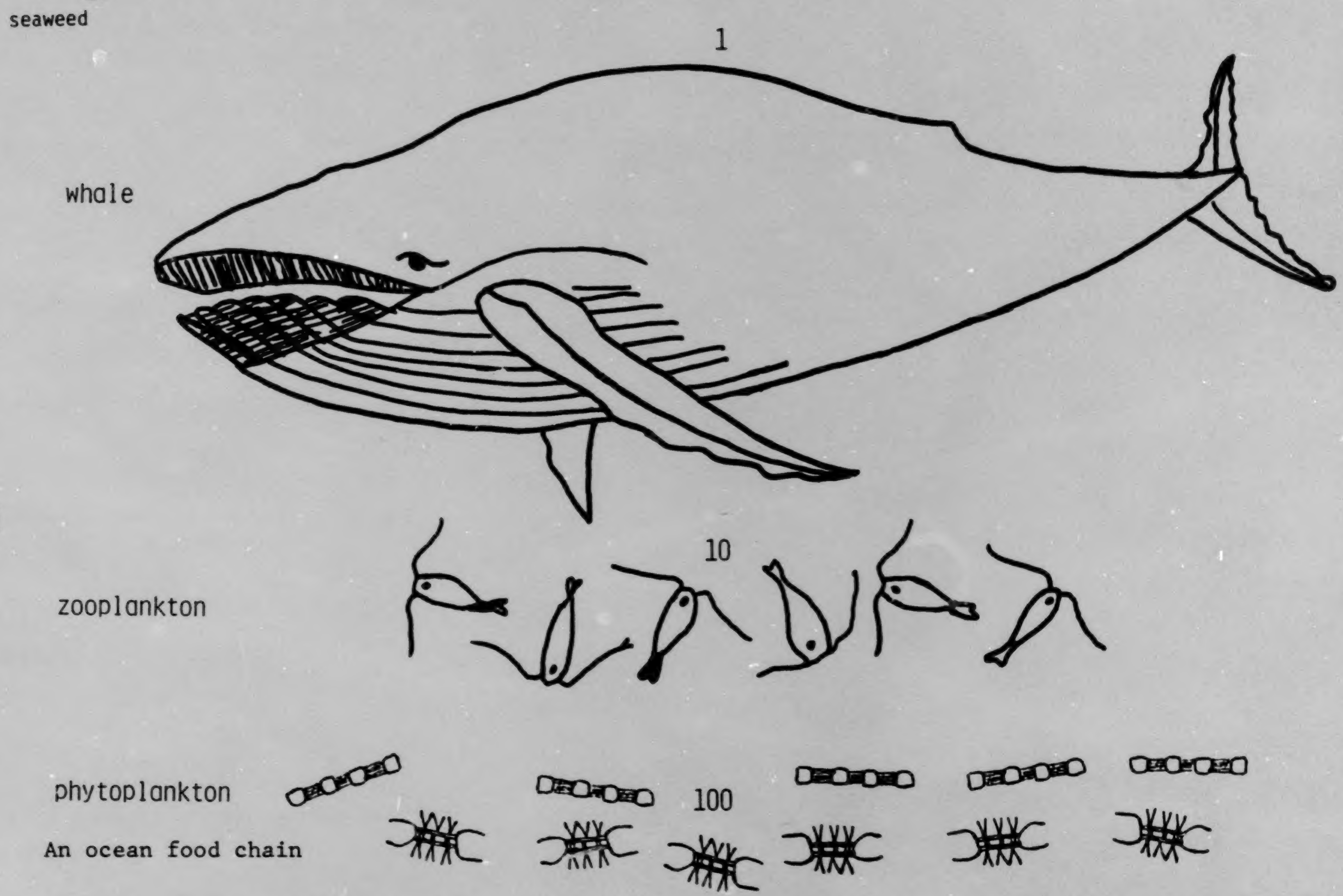
KEY WORDS

air sack
algae
anchor
attach
baldes
chemicals
drift
holdfast
leaves
medicine
piggyback
plankton
roots
seaweeds
stems
stipe
tasty



This is a sea palm.

1. Can you find the stipe? Color it brown.
2. Color the holdfast darker brown.
3. Color the blades green.

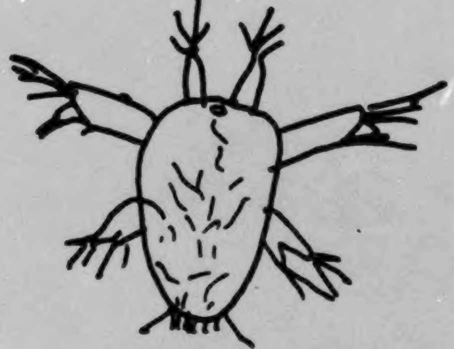

seaweed
1
whale
10
zooplankton
phytoplankton
100

An ocean food chain

1. Circle the producers.
2. Draw a box around the 1st consumers.
3. Color the 2nd consumer blue.

after OSU "phytoplankton - grass of the sea"

seaweed



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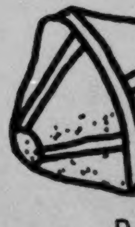
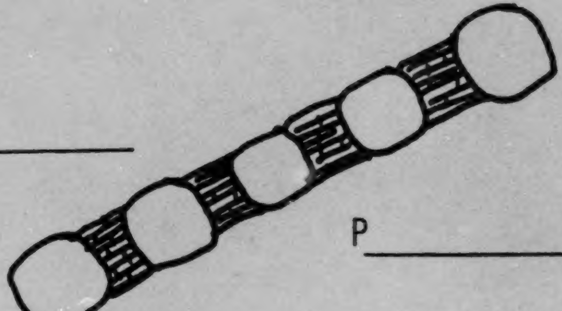
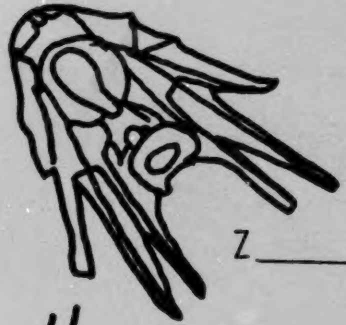


P____________



P_______________



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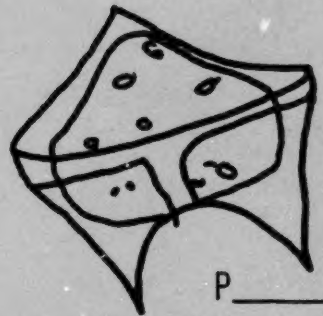

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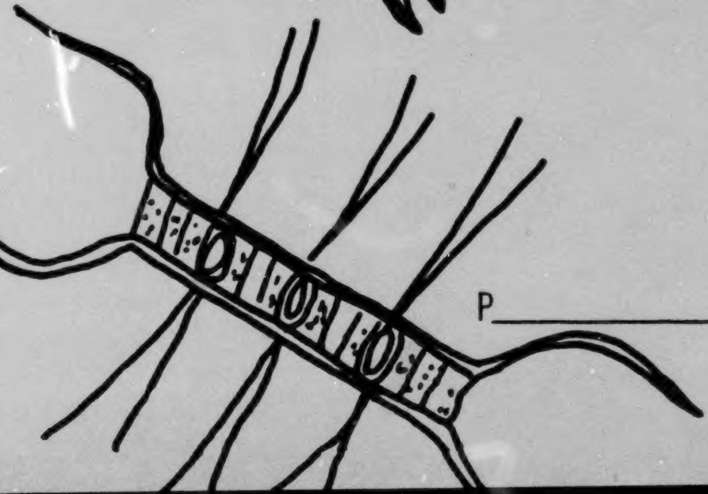


P_____________

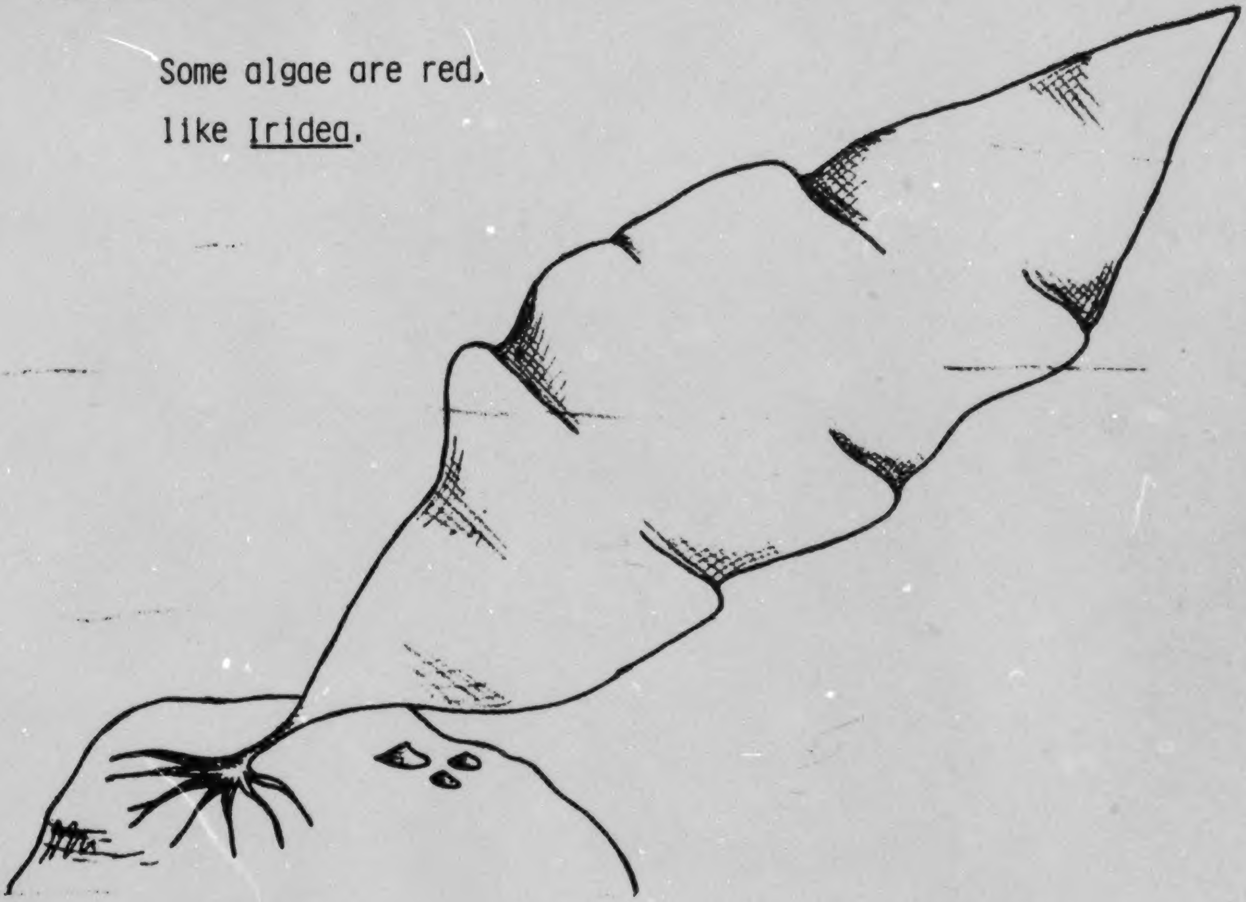
"Yum! Phytoplankton and zooplankton for dinner".

Follow the directions on the back of this page.

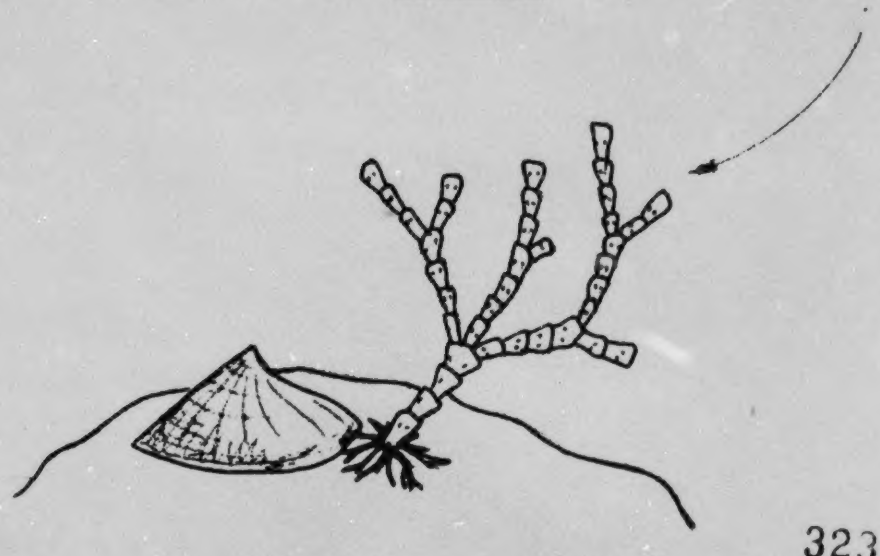
1. These are phytoplankton or zooplankton. Fill in the blanks.
2. Draw an x on all the producers.
3. Draw a circle around the first consumers.
4. Draw a line over the second consumer.
5. Color these animals.

overhead

Some algae are red,
like Iridea.



Some of the red algae have a hard mineral coating.
These are the small coralline (kor-a-lin) algae.



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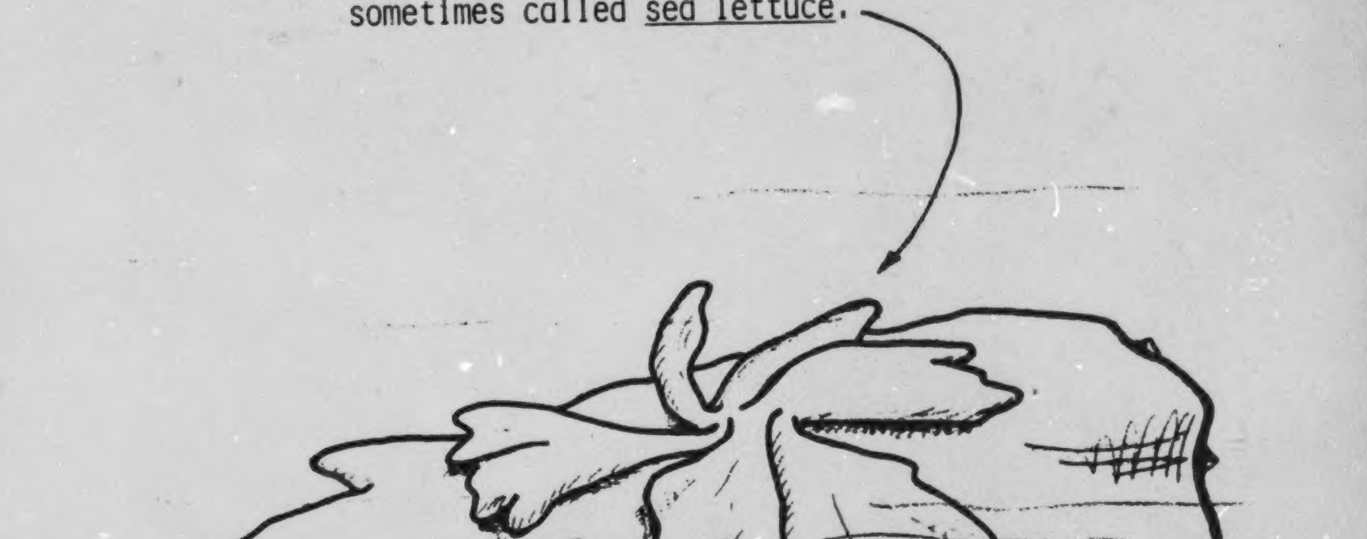
overhead

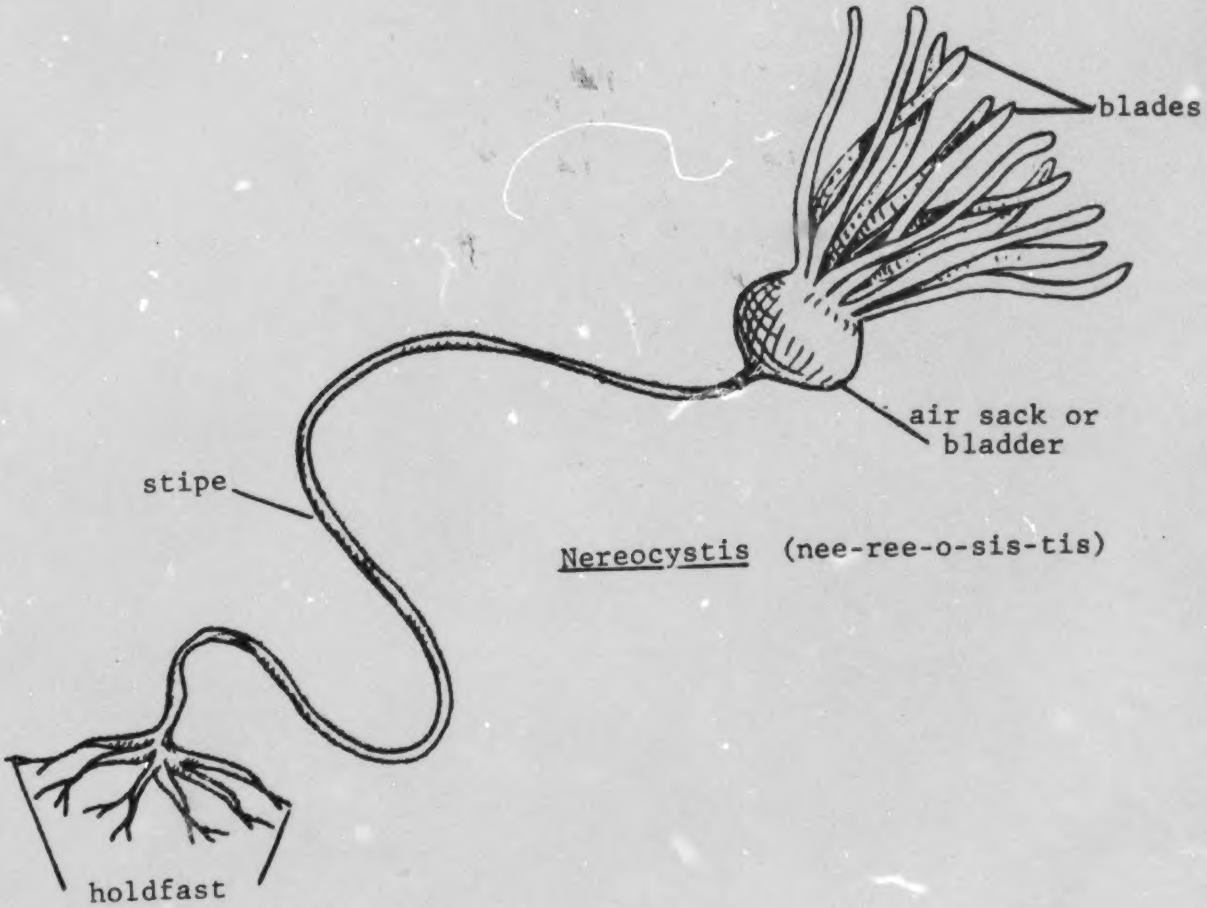
Most of the snails eat algae (al-gee) by scraping it with a file-like tongue.

Some algae are green, like Ulva, sometimes called sea lettuce.



overhead

Other algae are brown
and very large.


blades
air sack or
bladder
stipe
holdfast

Nereocystis (nee-ree-o-sis-tis)

One of these is the common large kelp.

Name ____________________________ Page 1

SEAWEEDS

Some plants in the sea are very small. They drift free. Small plants and animals that drift free are called plankton.

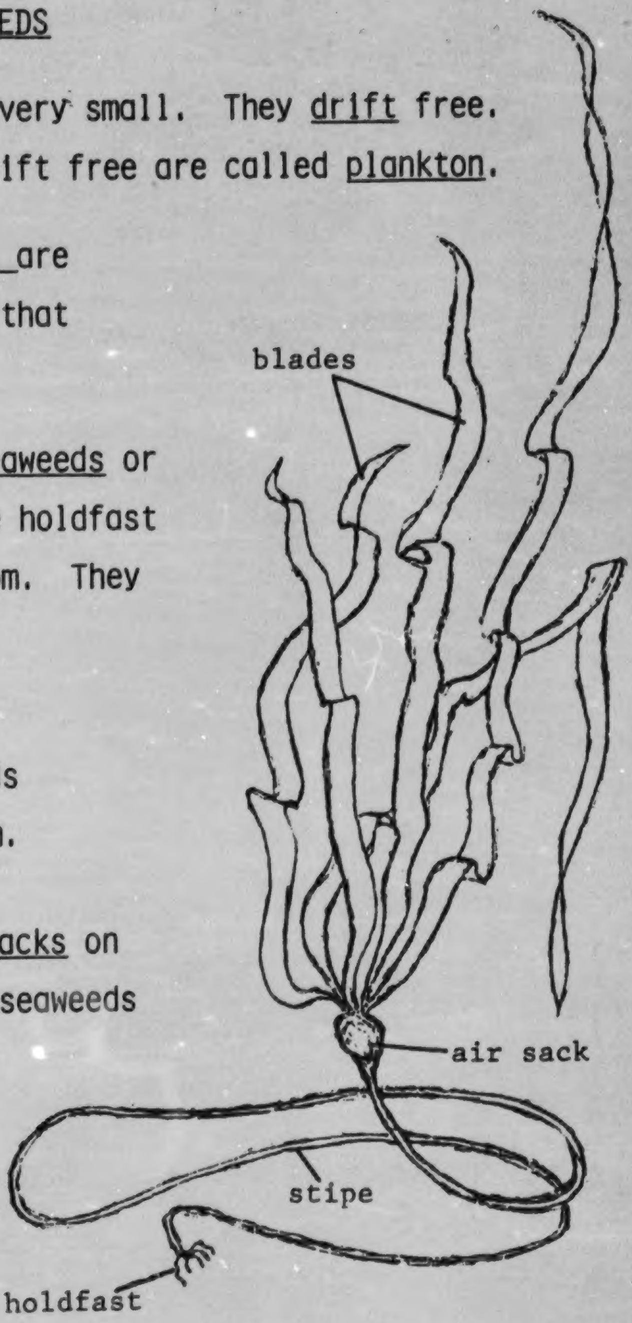
1. ____________________________ are small plants and animals that drift in the sea.

Larger plants are called seaweeds or algae. They have a holdfast. The holdfast anchors the seaweed to the bottom. They also have a stipe and blades.

2. The ________________ holds the seaweed on the bottom.

Some kinds of seaweeds have air sacks on their blades. The air sacks help the seaweeds float.

The holdfast, stipe and blades are similar to the roots, stems and leaves of a tree.



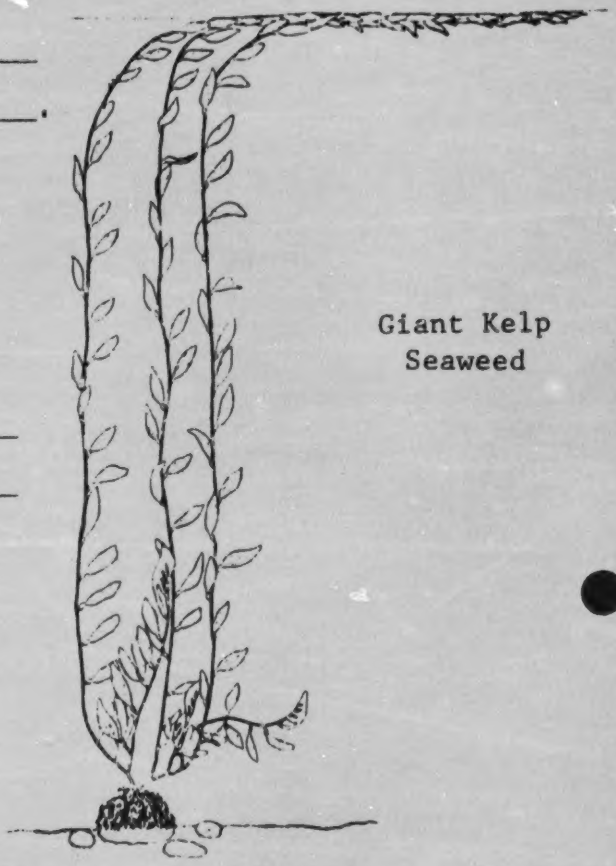
Seaweed

3. The ______________________ are like the leaves of a tree.

Name ______________________________

Seaweeds use their holdfast to attach themselves to rocks. Sometimes they attach piggyback on shellfish.

4. Seaweeds live on ________________
and on ______________________________.



Seaweeds make a tasty dinner. Many sea animals eat them.

5. Do any sea animals eat
seaweed? ________________________
____

Sometimes man also uses seaweeds. We use seaweed in food, chemicals, and medicine. Seaweed is used to make ice cream smooth.

6. Have you ever eaten seaweed? ________________________________
____

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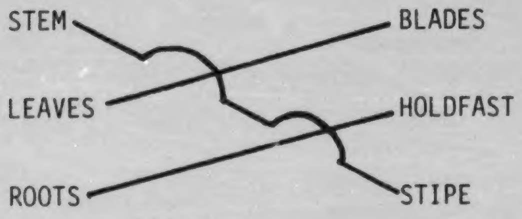
TEACHER BACKGROUND - Sea Parts

"Sea Parts" emphasizes the similiar structures of seaweeds and land plants. The structures are similar in shape and, to a degree, in function. Internally they are vastly different and some of their physiological functions are also quite different. Even so, the parts look similiar and the comparison is valid.

Duplicate one "Sea Parts" page per student. Students should have little trouble completing this individually. The answers are to be found directly in the text. The "Key Words" should be taught if they are unfamiliar to the students. Plan to devote a minute to provide the correct answer. Discuss the relationship between structure and function as you summarize this activity.

KEY



KEY WORDS

blades
connect
holdfast
leaves
plants
roots
stem
stipe

Name ______________________

SEA PARTS

Match the parts of the land plants to the similiar parts of the sea plants.

STEM	BLADES
LEAVES	HOLDFAST
ROOTS	STIPE

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TEACHER BACKGROUND - Food Chains

This exercise deals with some of the interrelationships that exist in feeding. "Food Chains" introduces formally the terms "producer", "consumer" and "food chain". While the student is taken through the development of the terms in a stepwise fashion, the exercise should be previewed by the teacher prior to having the students begin work. As you preview, look for areas which may present difficulties for your class. Be aware of these areas when you teach the material. The "Key Words" should be taught if they are unfamiliar to the students.

Duplicate the "Food Chains" pages. One set per student is recommended. Supplement the activity with pictures of sea urchins, kelp, sea otters, and other marine life. Students may work individually but much can be gained in an activity like this from having your students work in small groups.

Allow ample time upon completion to go over the activity. Walk the students through the entire activity to be sure that the concepts introduced have been mastered.

KEY - Text questions

1. Producers: giant kelp seaweed, green seaweeds, and algae
2. Yes, the sea urchin is a first order consumer since it eats the plant (giant kelp) directly.
3. An otter would be a second consumer if it ate the sea urchin.
4. Something that eats a second consumer is called a third consumer.
5. Grass ⟶ cow ⟶ man
6. Seaweed ⟶ Sea urchin ⟶ sea otter

Display the pictures on a classroom bulletin board for everyone to see and enjoy.

KEY WORDS

consumers

cow

first consumers

food chain

giant kelp seaweed

grass

moon snails

otter

oysters

plant

producers

seaweed
sea anemone
sea urchin
second consumers
third consumers

331

Name ____________________________

FOOD CHAINS

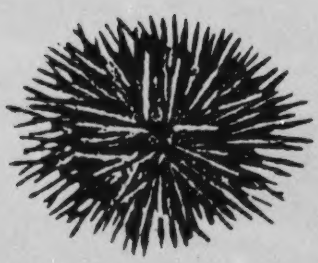
Seaweeds make food. We call plants like seaweed producers. Animals can't make food. They need to eat plants or other animals. We call animals consumers.

1. Read the words below. Circle the producers.

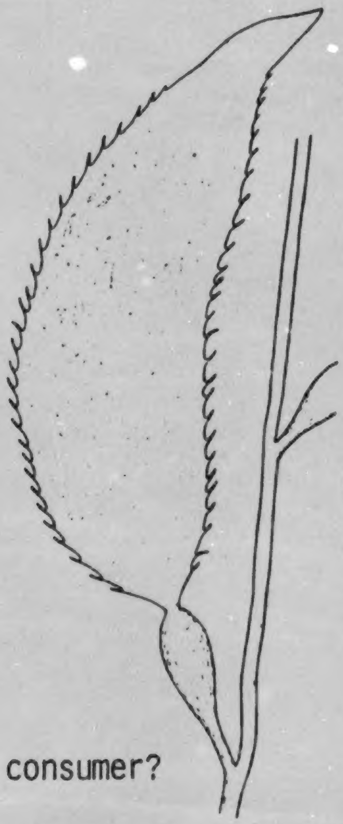
giant kelp seaweed | moonsnails | green seaweeds

oysters | algae | sea anemones

Animals that eat plants are called first consumers. They are the FIRST to eat the plant. The sea urchin eats kelp seaweed.



Sea Urchin



Giant Kelp
Seaweed

2. Is the sea urchin a first order consumer?

____

____

Name ______________________

Animals that eat first consumers are called second consumers. They are the SECOND to eat the plant.

3. An otter would be a ______________________ consumer if it ate the sea urchin. (Remember, the sea urchin is a first consumer).

4. What do you think something that eats a second consumer is called? ____

____

Below is a food chain. It shows who eats whom.

giant kelp	⟶	sea urchin	⟶	sea otter
(producer)		(first consumer)		(second consumer)

5. Make a food chain with these: man, grass, cow.

6. Make a food chain with these: seaweed, sea otter, sea urchin.

Name ______________________________

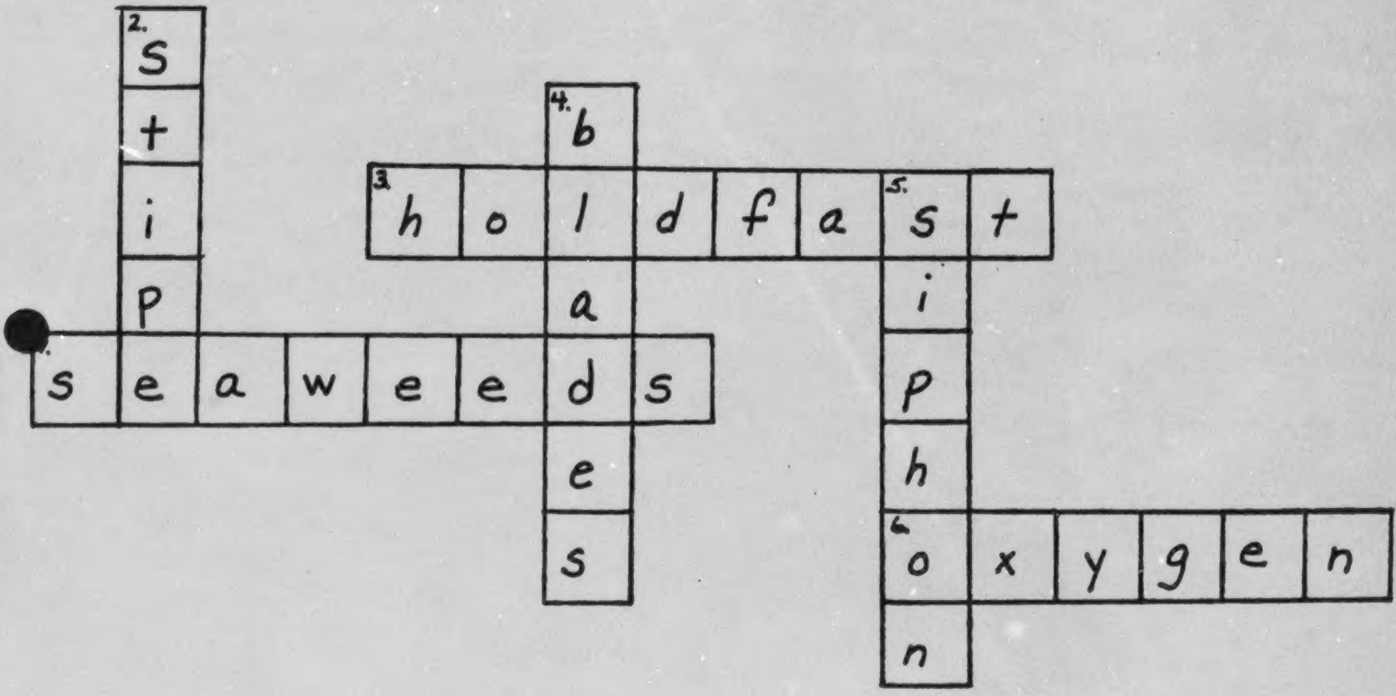
7. Draw a food chain. Draw pictures of the animals in your chain. Color the plants and animals. Write their names.

TEACHER BACKGROUND - Cross Your Seaweed

This crossword puzzle is designed as a review of the material in this section. The vocabulary needed is listed on the puzzle page. The "Key Words" should be taught if they are unfamiliar to the students.

Duplicate the puzzle. One puzzle per student is recommended. Students may work individually or in small groups. Material exchange in small groups is often helpful in this type of vocabulary exercise. Be certain that your students understand how to do a crossword puzzle. Note that this puzzle has a simplified numbering scheme. Provide the assistance necessary to get your class started on this exercise.

KEY



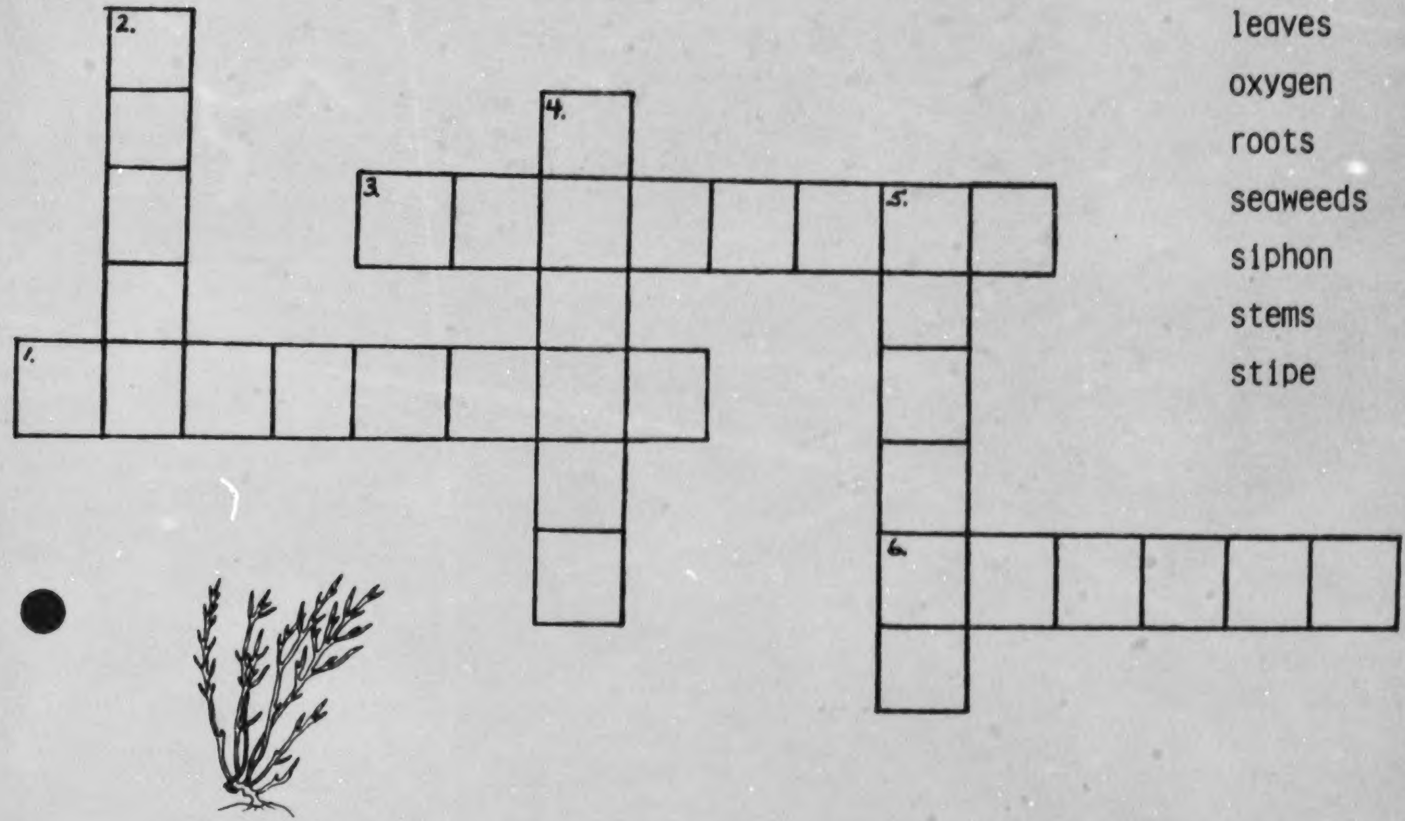
KEY WORDS

The "Key Words" are those reinforced by the crossword puzzle.

Name ______________________________

CROSS YOUR SEAWEED

blades
holdfast
leaves
oxygen
roots
seaweeds
siphon
stems
stipe



1. Sea plants are called ________________.
2. The ________________of a seaweed is similar to the stem of a land plant.
3. Seaweeds use their ________________to anchor themselves to the bottom.
4. The ________________of a seaweed are sometimes held up by air sacks.
5. Clams use their ________________to take water and food into their bodies.
6. O_2 stands for ________________.

TEACHER BACKGROUND - Plants?

Growing seaweeds in a classroom is not practical. In "Plants?" we use a model. The growth of crystals is substituted for the growth of plants. While the two kinds of growth are vastly different, we can use crystal growth to help your students think about the growth of marine plants.

Duplicate the experiment pages. One set per student is recommended. This is a good activity for individual participation, but it will also work well using pairs or small groups of students.. Caution your students to be careful with the bluing and the ammonia. You may wish to dispense the ammonia yourself. Provide adequate ventilation at all times. Provide time the second day to discuss the text questions and experimental results. The "Key Words" should be taught if they are unfamiliar to the students.

KEY - Text questions

4. a. The soil for the garden is the aluminum foil.
   b. The soil for seaweeds is the sea bottom. Actually, the soil for sea plants is the sea itself. Most sea plants are free floating and those that are anchored seldom have true roots. The sea provides the nutrients required for life, just like the soil provides them on land.
5. a. Answers depend upon experimental results.
   b. There probably will be spots without crystals.
   c. No soil, no water, no sun, heat, or cold among others could keep a plant from growing.
   d. No, all plants in the sea do not need soil.

Page 4.

1. The crystals are different from plants in many ways: they can't produce new crystals, differ in color, size, texture, etc. Any answers are acceptable but spend a few minutes discussing what makes something "alive".

KEY WORDS

aluminum foil

ammonia

base

breathe

bluing

crystals

different

grow

pour

soil

tablespoon

Name ____________________________

PLANTS?

Plants are the base for life in the sea. We can't easily watch them grow. We can grow some non-plants. Let's see what they show us about life in the ocean. Here is what you will need:

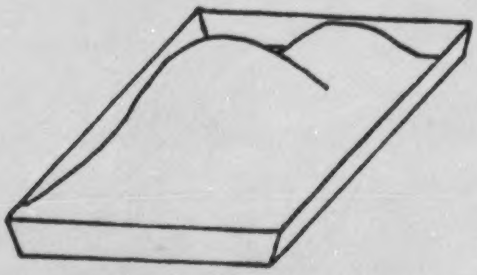
Materials:

a low dish or pie pan
2 or 3 feet of aluminum foil
an old tablespoon
cup
5 tablespoons of salt
5 tablespoons of bluing
5 tablespoons of water
1 tablespoon of ammonia

Here is how to do it:

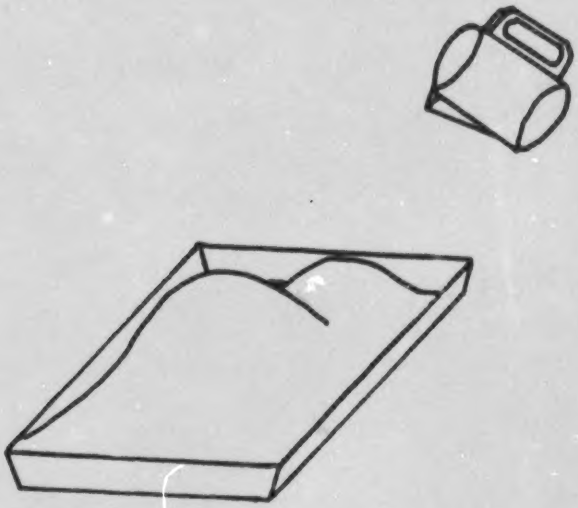
Procedure:

1. Crumple the aluminum foil into an uneven mountain-like shape. Place it in the pie pan. Completely cover the bottom of the pan with the foil.
2. In a cup mix the salt, bluing, water and ammonia. Be careful! Don't breathe the ammonia.



Name ______________________________ Page 2

3. Stir the salt mix. Pour it slowly over the foil. Wet all of the foil.



4. Put your garden aside until tomorrow.

a. What is the "soil" for this garden? ______________________________

____

b. Where is the soil for seaweed? ______________________________

____

Day 2

5. Look at your garden. The "Plants" are crystals.

a. Where did the most "Plants" grow? ______________________________

____

____

____

____

Name ____________________

Plants grow where they can. They can't grow everywhere.

b. Are there spots where no crystals grew? ______________

____

c. What could keep a plant from growing? ______________

____

d. Do all plants in the sea need soil? ______________

____

Next time color your garden. Here's how:

1. Sprinkle water paints, ink or food coloring on the foil as soon as the mix is poured.

Name two ways your crystals are different from real plants.

____

____

____

____

____

____

TEACHER BACKGROUND - Home Economics - Seaweed

Seaweed is not often thought of as a foodstuff. In reality, large amounts of seaweed are harvested each year for the food markets of the world.

The following receipes are included so that you might share this taste experience with your students. It is possible to make the items as a demonstration or to bring the prepared food from home for sharing. The most instructive approach involves student participation.

If you elect to have the students prepare the food, there are some things to keep in mind. Before beginning, read and understand the sequence of steps. Anticipate any problems your particular class might have. Be continually aware of hot items and knives. All of the ingredients may be purchased in most grocery stores. Provide cups and spoons for serving. Serve a small amount to each student, but force no one to eat. Your enthusiastic consumption will do more than requiring them to eat the prepared food. Most of these items may be prepared in the classroom. All may be prepared on an electric hot plate or conventional stove if you have access to one (cafeteria staff are sometimes quite willing to allow some of their equipment to be used in the afternoon).

This is a golden opportunity to expand vocabulary skills and measurement skills. The recipes can be readily metricized. The activity also provides a good exercise in following directions. HAVE FUN!

If you elect to have the students do the cooking, you might wish to use a format similiar to that presented in "Down Home New England Clam Chowder" found elsewhere in this unit.

Sweet Alaska Sea Pickles*

Soak four pounds kelp two hours in a brine solution prepared by dissolving a cup of salt in two gallons of water. Care must be taken to keep the kelp covered with the brine. Remove and wash kelp thoroughly with cold water. Cut kelp in one-inch cubes and soak in an alum solution (1/2 teaspoon alum to two quarts cold water); then drain and wash in cold water and drain again. Place kelp in enamel pot, cover with boiling water and cook until it can be pierced with a fork. Drain.

Combine 3 1/2 cups sugar, a pint white vinegar, 1/2 teaspoon oil of cinnamon and 1/2 teaspoon oil of cloves and boil two minutes. Pour mixture over the cooked kelp. Let stand overnight in the enamel pot or crock. In the morning heat both the kelp and the syrup to the boiling point. Pack in jars and seal while hot.

Kelp Pickles*

Peel kelp with a potato peeler. Slice kelp into thin rings. Soak the washed kelp in cool water for three days. changing the water two or three times each day. On the fourth day cover the rings with fresh water, bring it to a boil and simmer 12 to 14 minutes.

For each quart of drained cooked kelp rings, bring 3/4 cup white vinegar, 2 1/2 cups sugar and a bag holding one tablespoon mixed pickling spices and one teaspoon whole cloves to a boil and simmer five minutes. Remove the spice bag and pour the hot syrup over the kelp rings and allow the rings to steep overnight. The next day drain off the syrup, heat it to boiling and again pour it over the kelp. After another night of steeping drain off the syrup, transfer the kelp to hot jars, cover it with boiling syrup and seal the jars.

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Kelp Grape Conserve*

Use kelp stripes (stems) no longer than 15 feet and chop off the bulb and any tail less than 3/4 inches across.

Cut approximately four pounds bulb kelp into 12 inch lengths and slit the bulbs. Remove dark surface layer. Soak kelp eight hours in a brine solution (two cups salt dissolved in two gallons cold water). Remove kelp from brine and wash thoroughly with cold water.

Grind the drained kelp in a food chopper, using a medium fine plate. Combine five cups ground kelp, five cups sugar, 2 1/2 cups grape juice and the juice of three lemons in an enameled pot. Cook mixture over high heat 30 minutes and another 30 minutes at medium heat The mixture begins to thicken during the last 30 minutes and must be stirred frequently with a wooden spoon. Pour the hot conserve into hot sterilized jelly glasses and seal immediately with hot paraffin.

Kelp Mint Marmalade

Use kelp stripes (stems) no longer than 15 feet and chop off the bulb and any tail less than 3/4 inches across.

Cut approximately four pounds bulb kelp into 12 inch lengths and slit the bulbs. Remove dark surface layer. Soak kelp eight hours in a brine solution (two cups salt dissolved in two gallons cold water). Remove kelp from brine and wash thoroughly with cold water.

Grind the drained kelp in a food chopper, using the medium fine plate with 1/4 inch holes. Combine five cups ground kelp, five cups sugar, 1 1/3 cups vinegar and six drops green vegetable coloring in an enamel pot. Cook mixture 30 minutes over high heat; add eight drops oil of peppermint and continue cooking 30 minutes longer at medium heat, stirring frequently with a wooden spoon. Pour hot marmalade into hot sterilized jelly glasses.

The trick-- or main point -- is to be sure the kelp is fresh from the sea, picked from a growing bed. Kelp from the beach or found floating will not give good results. It can be kept fresh a few days on a boat by submersing in sea water in a bucket or tub. Change water daily.

Kelp is easier to handle if it is allowed to drain well several hours before cutting it into 12 inch lengths (split the bulbs) and peeling it with a vegetable parer to remove the dark surface layer. Clean the centers with a bottle brush.

Bread made from seaweed

1. Collect about 2 pounds of seaweed.
2. Wash thoroughly in water.
3. Dry in the sun for several days.
4. Grind algae in a food blender until it is powdery.
5. Dissolve 2 packages of yeast in 1/2 cup warm water and one tablespoon sugar. Let stand for about 15 minutes until the yeast foams.
6. Add 1 cup warm water, the yeast mixture, and 3 tablespoons of liquid shortening to the powdered algae.
7. Blend the ingredients until smooth. Mnead them on a board into a ball. Cover the dough and let stand for about 15 minutes. Knead down and shape into a loaf. Place the loaf in a well greased bread tin and cover with a cloth, let rise for about one hour.
8. Preheat oven to 375°, bake bread for about 40 minutes. It is done when thumped, and it sounds hollow.

For variation you could insert the algae flour into any bread recipe and use that instead of wheat flour, or you could use half algae flour and half wheat flour. (Good luck and happy eating!

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PLANTS AND ANIMALS DEPEND ON EACH OTHER

TEACHER BACKGROUND - Plants and Animals Depend On Each Other

This section re-unites the plant world and animal world for the student. The emphasis should be on the interrelationships that exist between plants and animals. These interrelationships can be the basis of an appreciation of all life.

In a balanced environment, plants and animals interact with each other. The plants provide food and oxygen for the animal kingdom and the animals provide carbon dioxide for plant use. Dead and decayed tissue provide some of the nutrients for the plants. In the process of photosynthesis, plants bind the sun's energy and store it as usable chemical energy (plant tissue or food). Most of the world's photosynthetic conversion takes place in the sea by plant plankton. The microscopic plankton community is made up of animals (zooplankton) and plants (phytoplankton). These microscopic organisms form the basis of life in the sea.

Virtually all animal sea life is oxygen breathing. Mammals breathe the atmosphere directly (eg., porpoise and whales). All others extract the dissolved gases from the sea water. The higher invertebrates and vertebrates have specialized gill structures for gas exchange.

Duplicate the pages of the text. One set is recommended per student. The basic concepts covered need to be discussed by the teacher. It may be necessary to explain the term "gas" as it relates to being a form of matter. It is possible the students will identify gas as gasoline.

Gas exchange may be more easily grasped if the students understand air is a mixture of several gases (principally 78% nitrogen, 21% oxygen, less than 1% carbon dioxide, and other trace gases). It may be helpful to explain that gases can be dissolved in liquids, such as sea water or a bottle of pop.

The "Key Words" should be taught if they are unfamiliar to the students. Coloring worksheets follow this Teacher Background Section. They are for reinforcement. They should be used after the text has been studied.

KEY - Text questions

1. Plants and animals need energy to live.
2. The sun's energy is stored in the food that plants make.
3. Sea plants get minerals from the water.
4. Animals can indeed live without sunlight provided there is sunlight for the plants! If there is no sunlight for the plants, the plants will die and so will the animals (eventually). The correct answer then depends upon your time frame. The answer is not as important as the opportunity for discussion provided by the question.
5. Plants breathe in the gas carbon dioxide (CO_2). We cannot see plants breathe.
6. Sea animals breathe in the gas oxygen (O_2). Emphasize that the breathing of sea animals is different from our breathing. We cannot use our lungs to "squeeze" oxygen out of the water.

KEY WORDS

animals
breathe
carbon dioxide
decayed
depend
energy
food
food chain
minerals
oxygen
plants
soil
sun
sunlight

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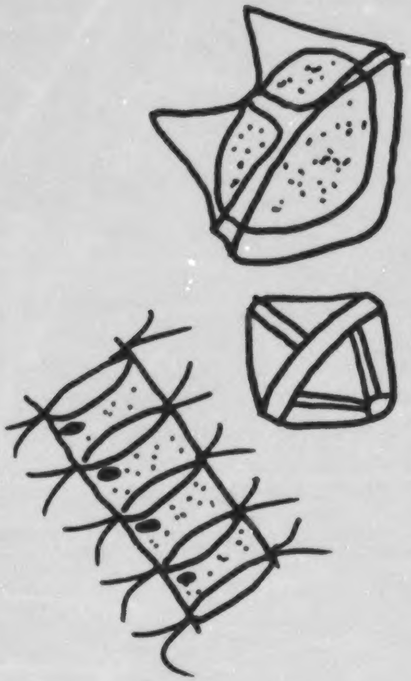
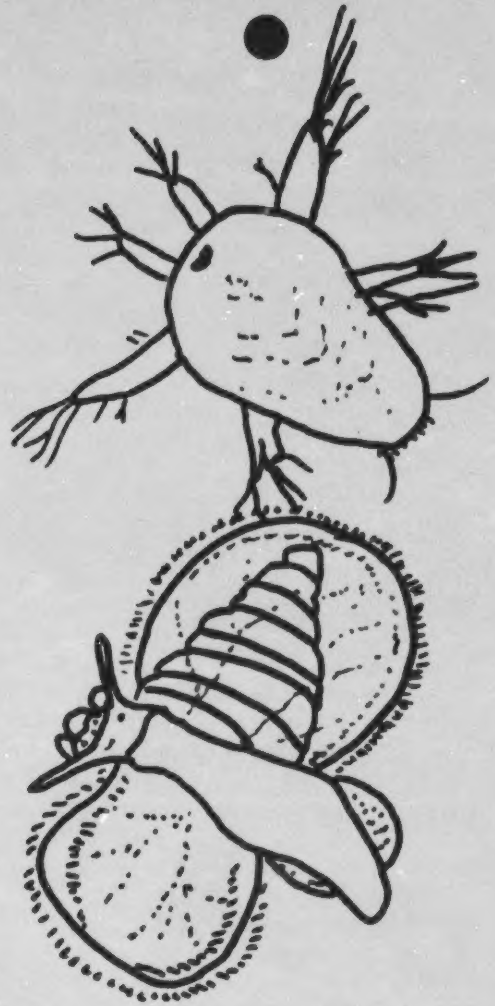
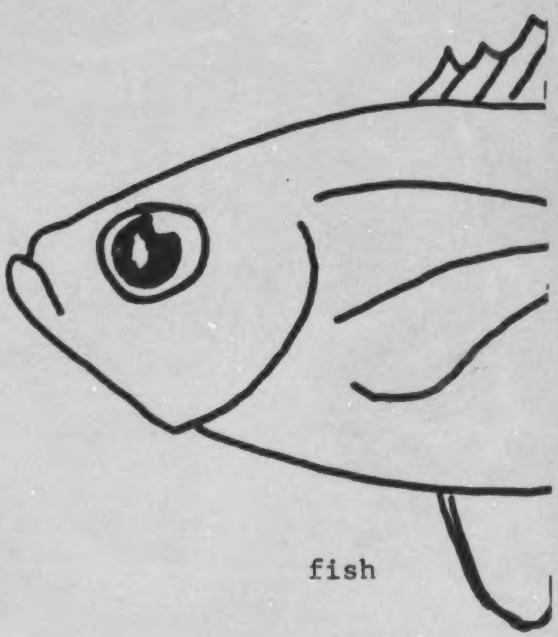
Plants and animals depend on each other



phytoplankton



zooplankton

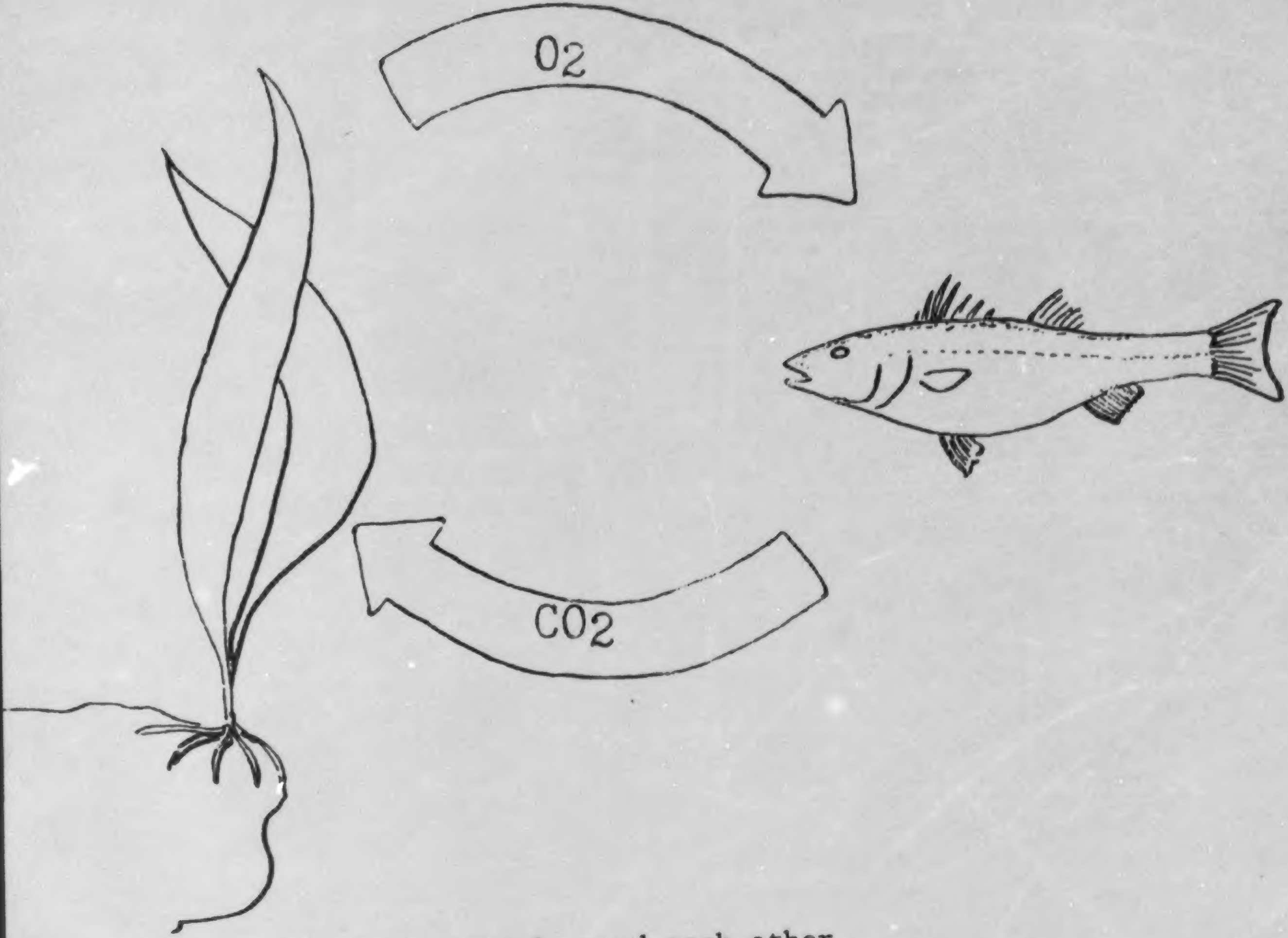


fish

What's Eating you?

1. These zooplankton depend on ____________ for food.
2. The fish depends on ______________ and ______________ for food.
3. Color the plants green.
4. Can you find the baby snail? Circle it.

overhead



Plants and animals need each other

Name ______________________________

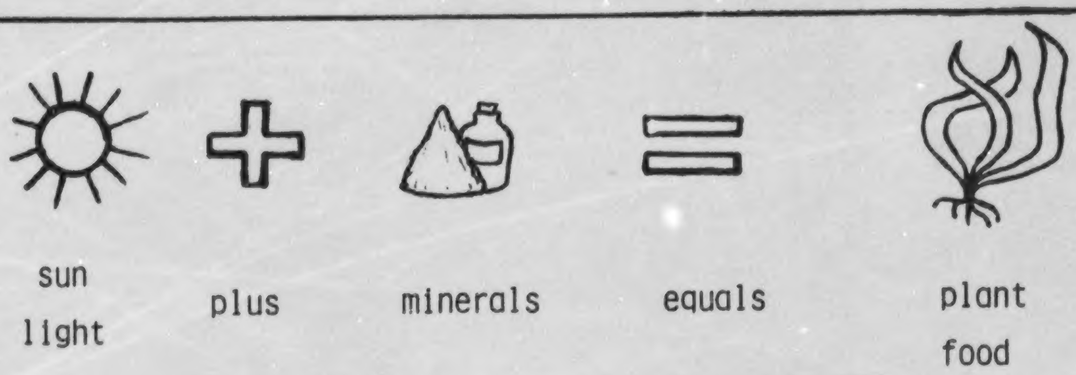
PLANTS & ANIMALS DEPEND ON EACH OTHER

Plants and animals depend on each other to live. Both plants and animals need energy to live. This energy comes from the sun.

1. What do plants and animals need to live? ______________________

____

Plants use the sun's energy to make food. The sun's energy is stored in the food. The animals get the sun's energy by eating the plants.



This is photosynthesis

2. Where is the sun's energy stored? ____________________________

____

____

Name ______________________

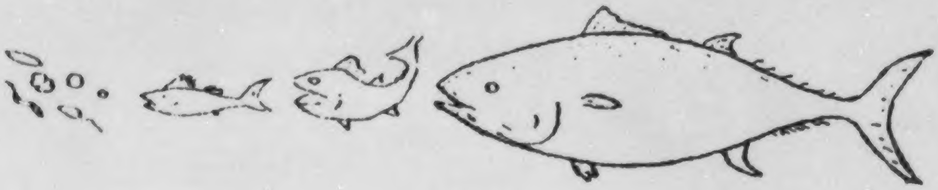
Sea plants take minerals from the water. The minerals are used to build the food. Plants on land take their minerals from the soil. Some of the minerals come from animals that have died and decayed.

3. Where do sea plants get minerals? ______________________

____

____

Small animals eat the plants. These small animals are eaten by large animals. This is called a food chain.



Food Chain

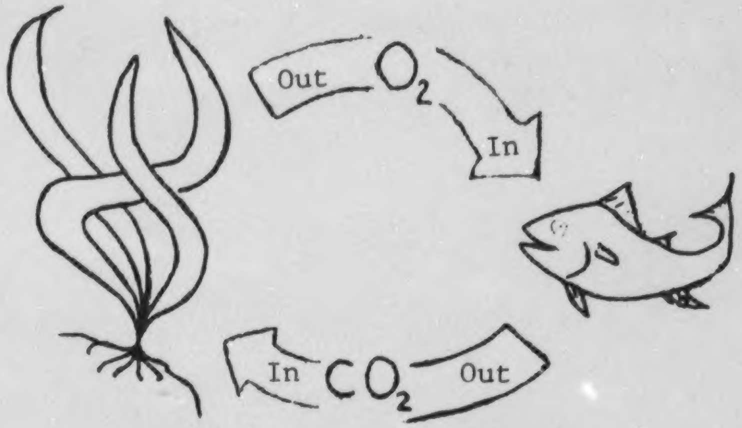
Plants would die without sunlight. There would be nothing for the animals to eat.

4. Can animals live without sunlight? ______________________

____

Name ______________________

Plants and animals depend on each other in another way. As plants grow they need the gas carbon dioxide. The symbol for carbon dioxide is Co_2. The plants then breathe out the gas oxygen. The symbol for oxygen is O_2. Animals breathe in the oxygen. They breathe out carbon dioxide. You cannot see a plant breathe.



Gas Exchange

5. Plants breathe in the gas ______________________.

Isn't it amazing how plants and animals depend on each other? Without plants, animals could not live. Without animals, plants could not live. Without sunlight, neither one could live.

6. Sea animals breathe in the gas ______________________.

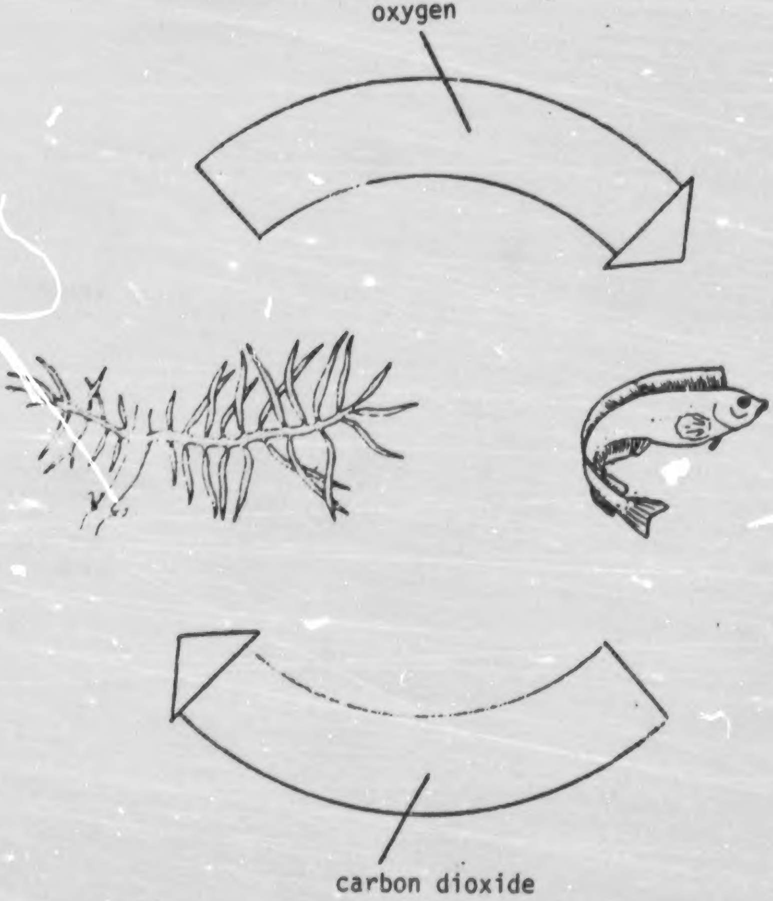
TEACHER BACKGROUND - Fill 'er Up?

This exercise is designed to give additional reinforcement of the concepts involved in gas exchange. The exercise also provides practice in categorization of items.

Duplicate the activity pages. One set per student is recommended. Students may do this exercise individually or in small groups at your preference. Upon completion, plan to discuss the activity and the basic concepts covered in the activity. Help your students to understand that plants produce the gas needed by animals and vice versa. It is important to note that at night plants respire just like animals. The cyclic nature of the interdependence is important to emphasize. Each organism has an effect on other organisms. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

Use Oxygen	Use Carbon Dioxide
CLAMS	TREES
BARNACLES	SEAWEED
HERMIT CRABS	GRASS



KEY WORDS

animal
arrow
barnacles
clams
carbon dioxide
hermit crabs
gas
grass
oxygen
plants
seaweed
trees

Name ______________________________ Page 1

FILL'ER UP?

Look at the names of the plants and animals. Which ones use carbon dioxide? Which ones use oxygen?

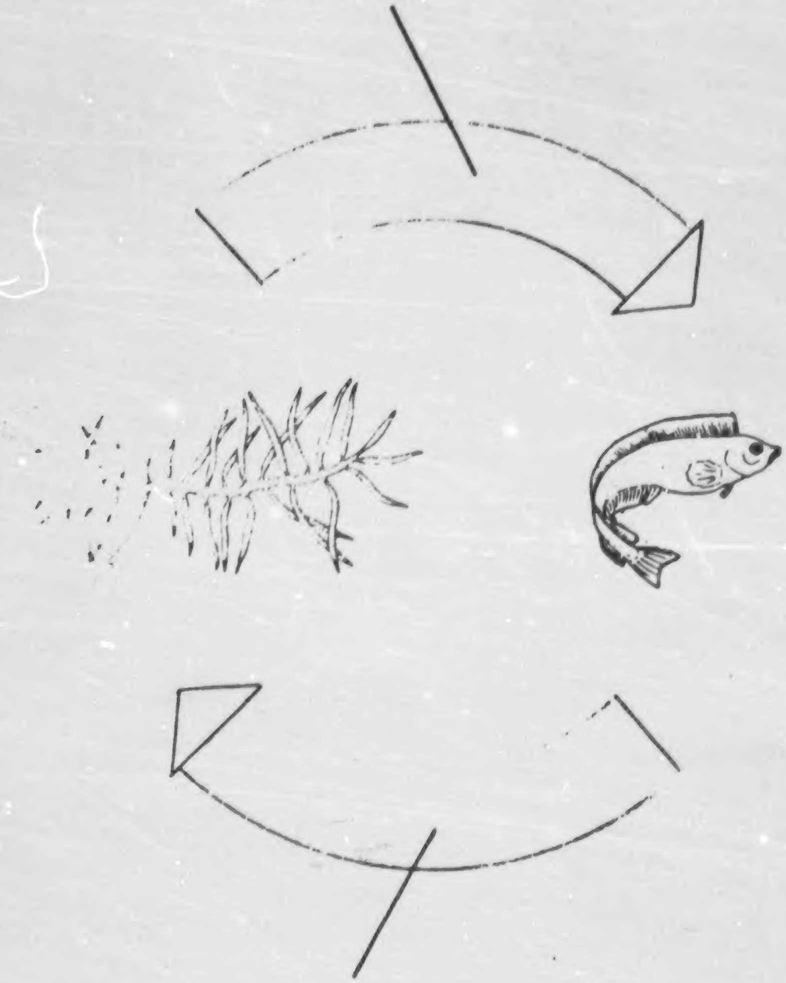
clams
seaweed
trees
hermit crabs
barnacles
grass

Use Oxygen	Use Carbon Dioxide

Name ____________________ Page 2

Each arrow stands for a gas. Name the arrows shown.

____



____

TEACHER BACKGROUND - Conseatration

"Conseatration" is played in the same manner as the traditional game of Concentration. This game helps reinforce the names and appearances of the sea creatures studied. The "Key Words" should be taught if they are unfamiliar to your students.

Duplicate the game. One game is needed per team of students. This game can be played with two to four players per team. Have the students cut along the lines, separating the board into twenty rectangles.

The game is played by placing each card face down in a four card by five card pattern. In turn, students select two cards and turn them over. If a match set occurs between the name and the organism, the student keeps the two cards. If no match occurs the cards are returned face down in their original position. The student with the most cards at the end of the game wins.

This game can be modified for use with other topics covered in this unit. To introduce or reinforce the mathematical concepts of graphing and coordinates, have the students call out their square choice using the squares coordinate position.

KEY WORDS

barnacle

chiton(Ki-ton)

clam

crab

fish

hermit crab

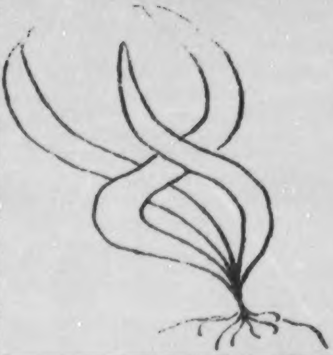
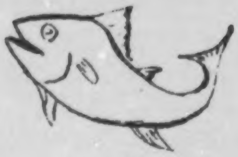
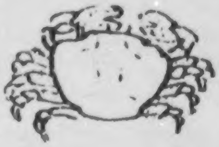
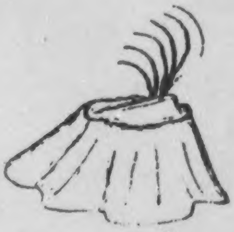
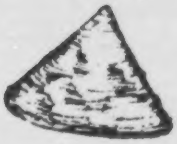
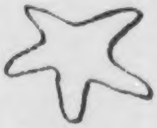
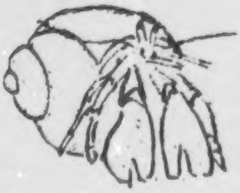
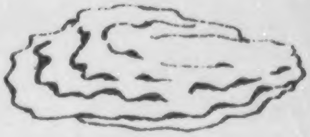
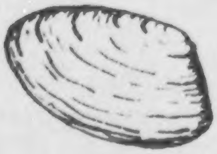
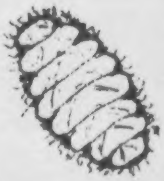
limpet

oyster

seaweed

starfish

353

OYSTER			STARFISH
HERMIT CRAB		CLAM	
	CHITON		LIMPET
FISH		CRAB	
	BARNACLE		SEAWEED

NATURE'S PROTECTION

TEACHER BACKGROUND - Nature's Protection

"Nature's" Protection" takes the concept of interrelationships stressed in the section "Plants and Animals Depend on Each Other" one step further. Plants and animals not only act in a cooperative fashion, they also interact in predator-prey relationships. It is important to stress that the relationships which exist maintain the stability of the world of life. As we simplify ecosystems by removing links in the food chains, we increase the chance of dramatic and drastic change within those systems.

This section deals with nature's way of keeping a balanced system. Some animals eat plants which, in turn, are eaten by other animals. Man plays a complicated role, for he is a harvester and sometimes, sadly enough, a depleter. Wise harvesting cultivates a crop while unwise use often eliminates it.

To help maintain nature's balance, each plant and animal has some means of protection to insure the continuance of the species. It may be a protective covering of shell or the ability to dig down into the bottom. It may be that the animal is capable of moving or swimming very fast and is thus able to outrun its predators. Some animals and plants maintain the species by reproducing in large numbers. Most of the young eventually are eaten or die. A few survive which keep the cycle going.

In this section "plankton" is again defined. Plankton are those forms of plant and animal life that drift, depending upon the currents for locomotion. They are the free floating microscopic plants and animals that, among other things, are responsible for the colors of the sea. When you see clear blue water it indicates an ocean desert, or the lack of planktonic life. A very simple yet accurate definition of plankton is any form of dirfting plant or animal life in the sea, regardless of size.

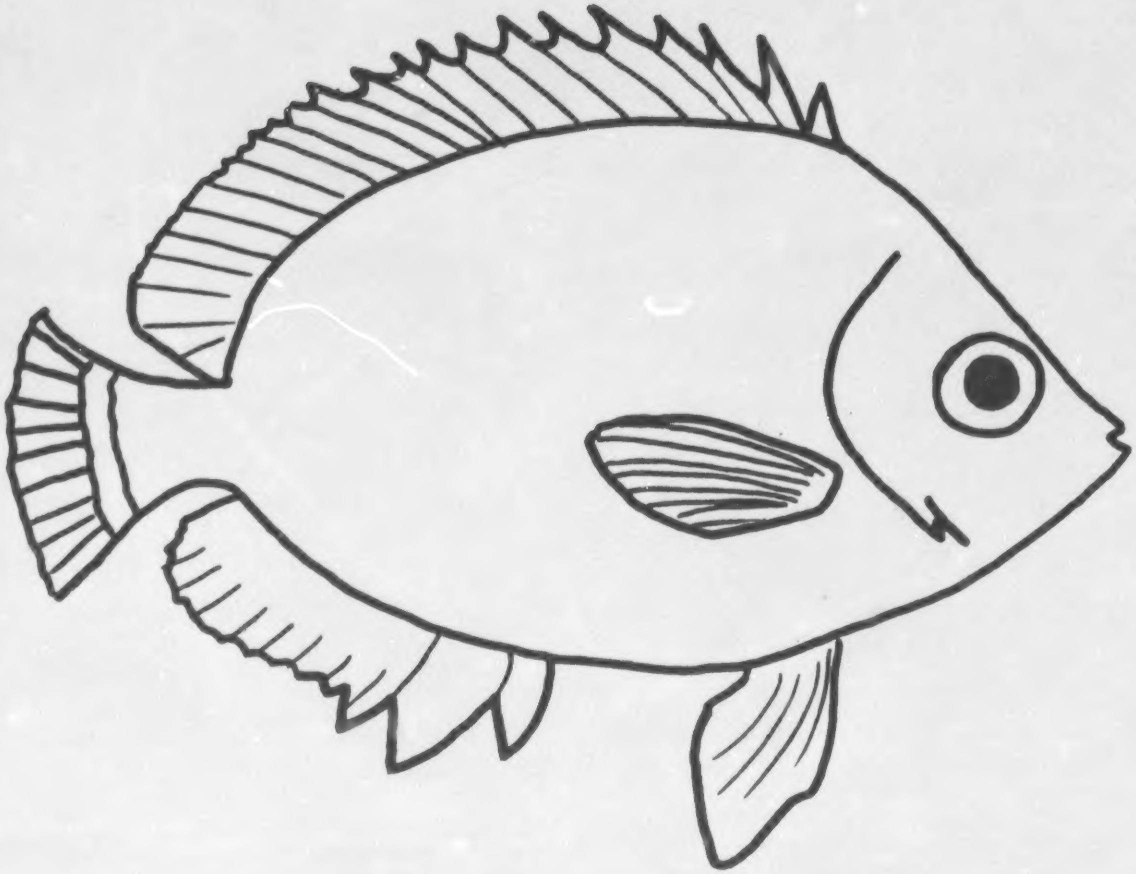
Duplicate the pages of the text. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. Continue to be aware of new vocabulary and teach the "Key Words" if they are unfamiliar to your students. The activities included are designed to reinforce the concepts introduced. Coloring worksheets follow this "Teacher Background" section. They are for reinforcement. They should be used after the text has been studied.

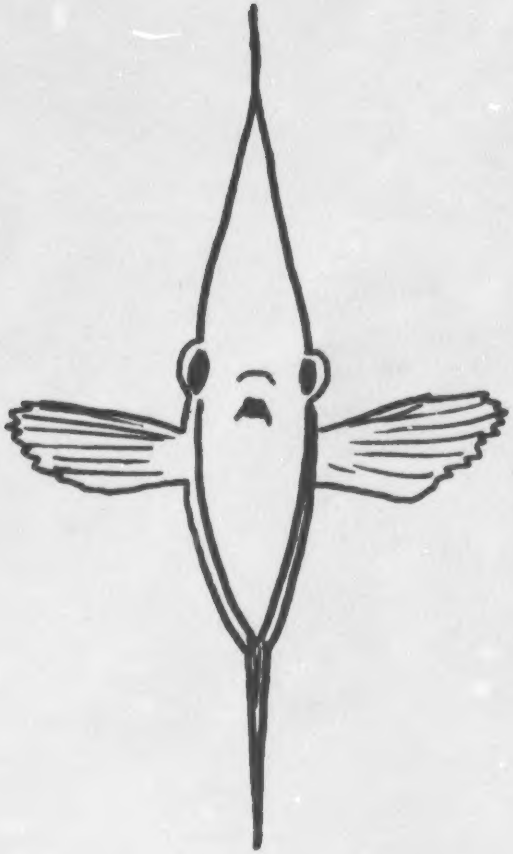
KEY - Text questions

1. Animals protect themselves:
    a. with pinchers
    b. by changing color
    c. with stingers
    d. by looking like something they are not
    e. with shells
    f. by moving fast
2. Some eggs live because mother animals lay ____many____ eggs.
3. Plankton move by ____drifting____.

KEY WORDS

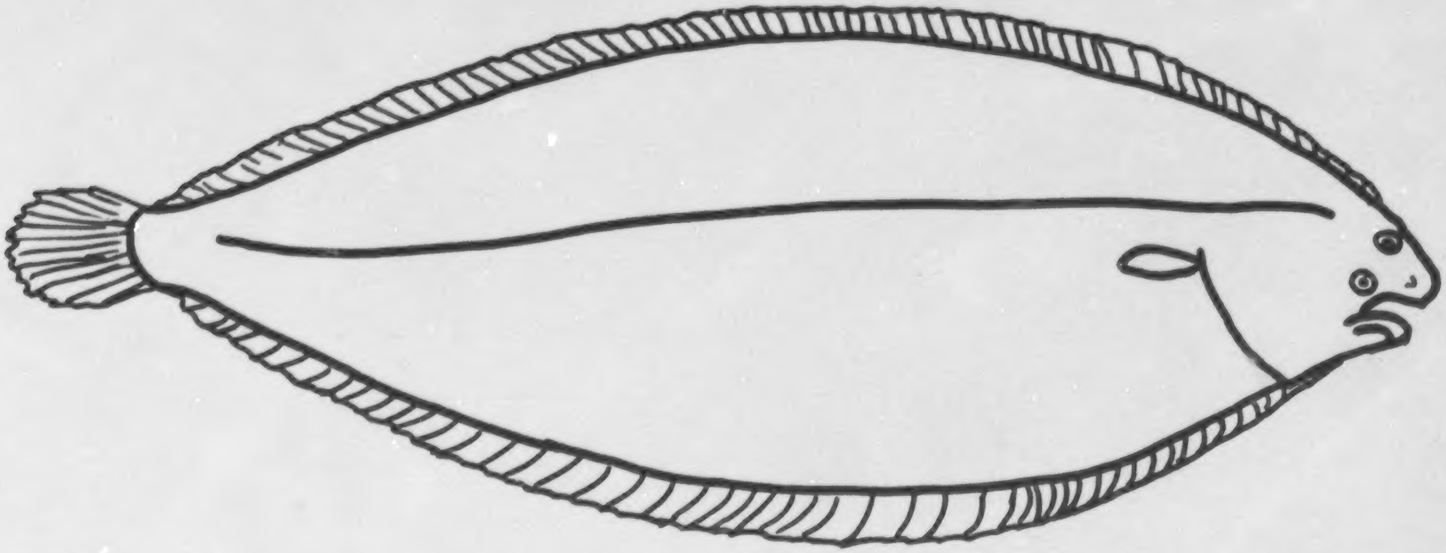
animals
clam
continue
drift
eggs
enemies
hermit crab
limpet
oyster
pebble
pinchers
plants
plankton
protection
species
stinger
stump
survive



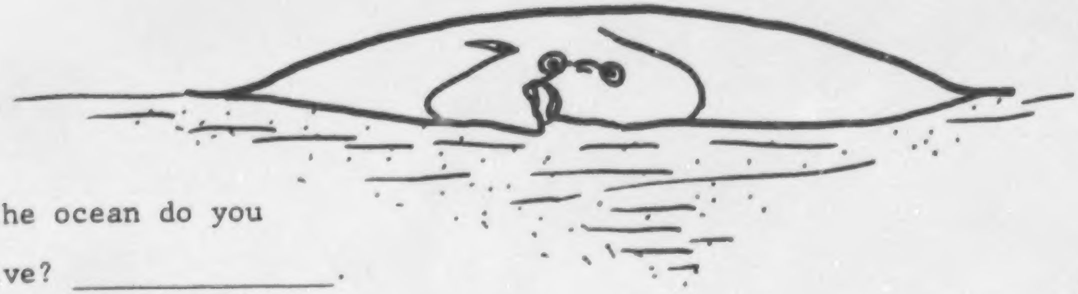


Now you see me, now you don't!

1. Draw a circle around the way I should face an enemy.
2. Color me so I can hide in the seaweeds.

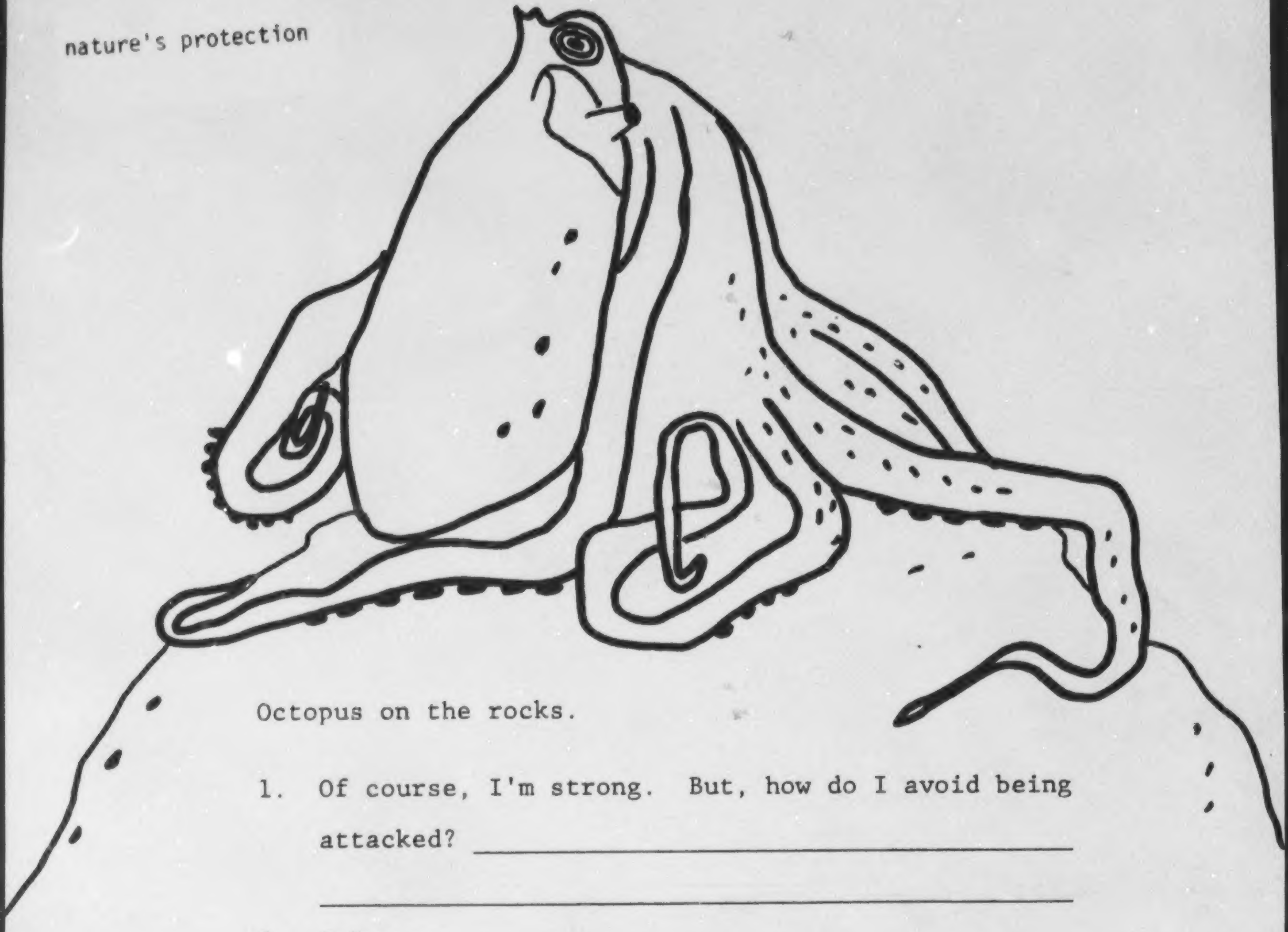


Now you see me,



now I'm lying low!

1. Where in the ocean do you think I live? ______________.
2. What color do you think I am? Color me that color.

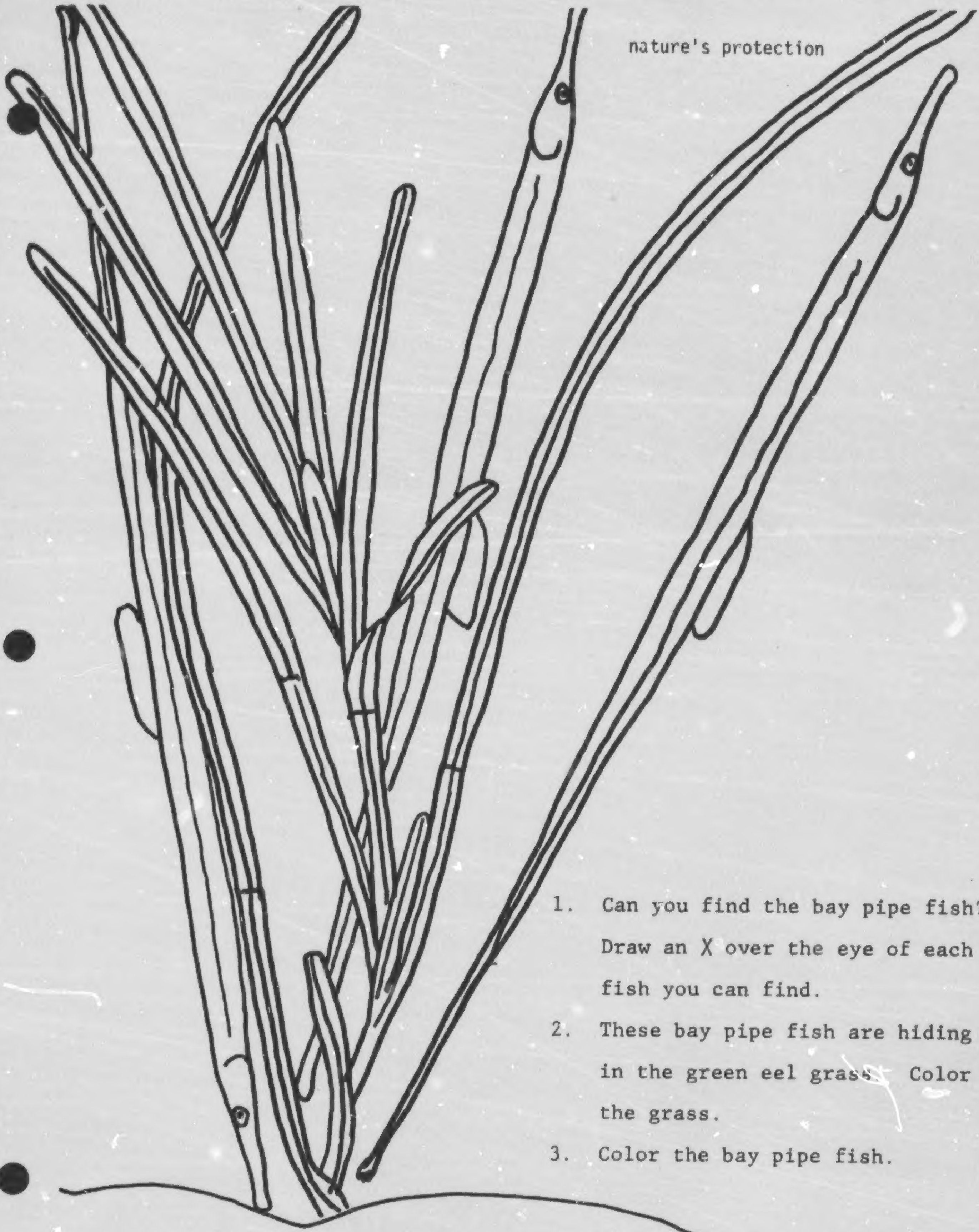


Octopus on the rocks.

1. Of course, I'm strong. But, how do I avoid being attacked? ______________________________

____

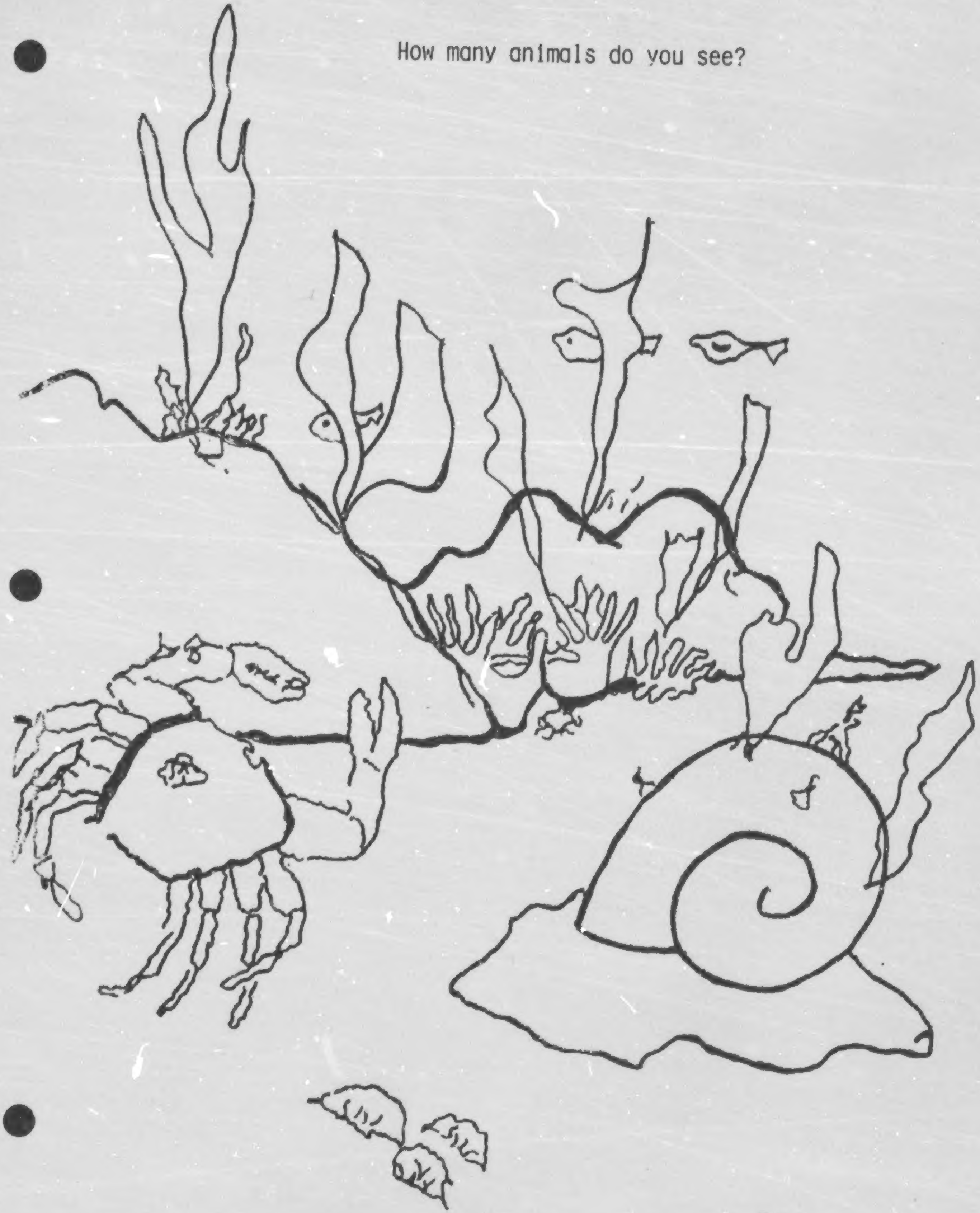
2. Color me.



1. Can you find the bay pipe fish? Draw an X over the eye of each fish you can find.
2. These bay pipe fish are hiding in the green eel grass. Color the grass.
3. Color the bay pipe fish.

overhead

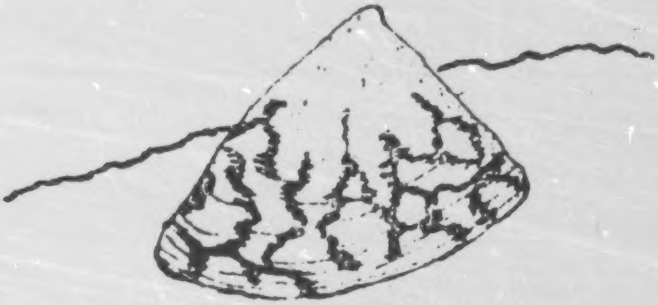
How many animals do you see?



Name ______________________________

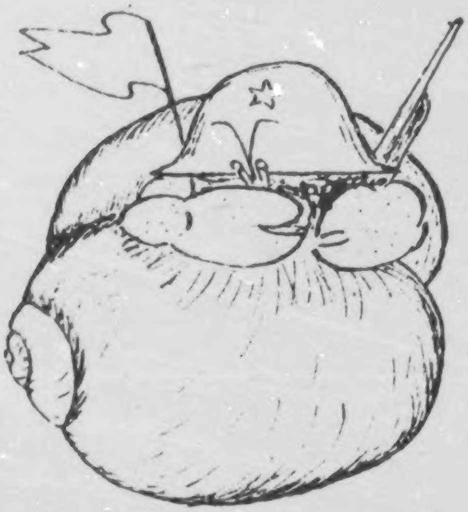
NATURE'S PROTECTION

Many plants and animals become food for other animals. All animals have ways to protect themselves. Some animals protect themselves with pinchers. Others change their color. Some use a stinger to keep their enemies away. Other animals look like something they are not. A limpet can look like a pebble. A sea anemone sometimes looks like a stump.



Limpets can look like rocks.

Many animals use shells for protection. The clam, oyster and the hermit crab are just a few.



Hermit crab ready to defend itself

Other animals can move very fast. It is hard for their enemies to catch them.

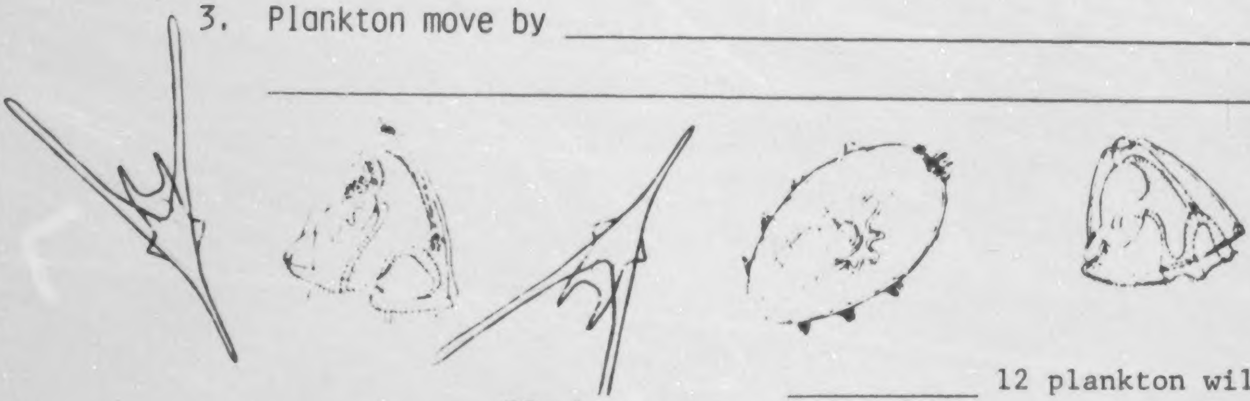
1. List 5 ways animals protect themselves.
   1. ______________________________
   2. ______________________________
   3. ______________________________
   4. ______________________________
   5. ______________________________

Nature helps marine life survive in other ways. Mother animals will lay many, many eggs. Sometimes these eggs drift in the water. These drifting eggs are called plankton. Many of the eggs are eaten. However, the mother laid many eggs. Some eggs will survive to continue the species.

2. Some eggs live because mother animals lay ____________ eggs.

Plankton are living plants or animals which can only drift in the water. They can not stop themselves. They can not decide where they will go.

3. Plankton move by ______________________________
____.



Plankton

__________ 12 plankton will fit on this line.

TEACHER BACKGROUND - Alikes

"Alikes" is designed to provide practice in looking for protective adaptations. It also provides some practice in categorization. The animals are a bit too small for detailed coloring. None-the-less, students enjoy coloring the line drawings.

Duplicate the "Alikes" page. One per student is recommended. Provide coloring materials. The students should have little trouble doing this exercise independently. Working in small groups is an alternative that provides for building social skills. Choose the technique you find most beneficial for your group. Plan to devote time to a discussion of the activity and of the basic concepts covered in the activity. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

Below are the names of the animals shown in "Alikes". The animals with the listed characteristic are underlined. Their pictures are the ones your students should have colored.

Group I	*crabs*	rock fish	*horse clam*
Group II	*seastar*	*limpet*	*chiton*
Group III	*flounder*	jellyfish	*pile perch*

KEY WORDS

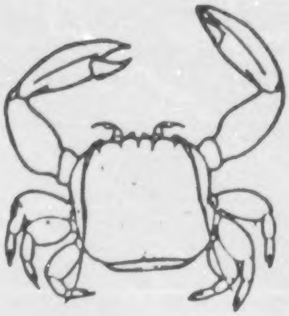
animals
color
group
protect
rock
shells
swim

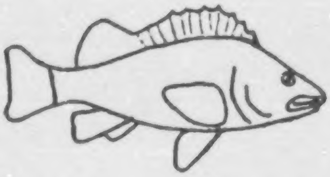
Name ______________________________

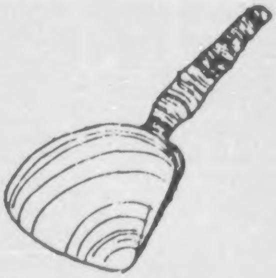
ALIKES

In each group below two of the three animals protect themselves in the same way. Color those two animals. Put an X through the animal that doesn't belong.

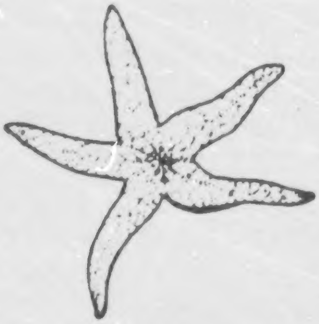
GROUP I. Animals that have shells

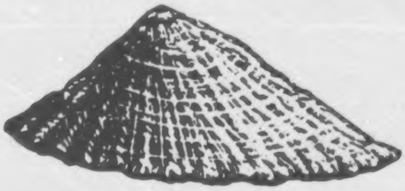


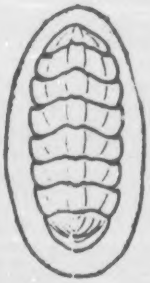




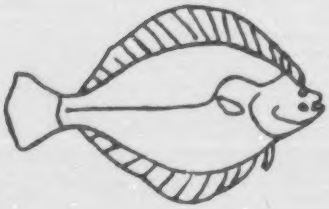
GROUP II. Animals that look like a rock

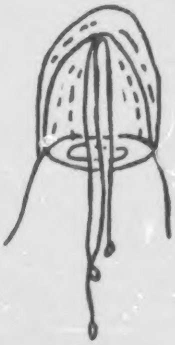


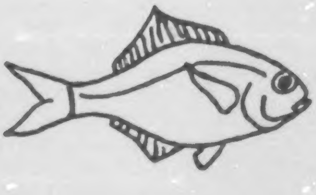




GROUP III. Animals that swim to get away







TEACHER BACKGROUND - Protect Me!

"Protect Me! Helps the student to focus on some of the specific adaptations possessed by marine animals. The exercise requires recall of material from previous sections. Use this opportunity to further integregate the various topics covered up to this point.

Duplicate the activity page. One is recommended for each student. The students may work independently or in small groups. There is something to be gained from each approach. Select the methods that will work best with your class. The answers should be discussed while emphasizing the basic concepts covered. Teach the "Key Words" if they are unfamiliar to your students.

KEY

Each of the animals shown has several ways in which it protects itself. Some, but not all, are shown below.

1. Crab - pinchers, shell, color, walking ability
2. Fish - swimming ability, streamlining, spines, coloration
3. Chiton - shell, coloration, strong hold on rocks
4. Seastar - hard back, coloration walking ability
5. Hermit crab - withdraws into shell, pinchers, coloration, walking ability

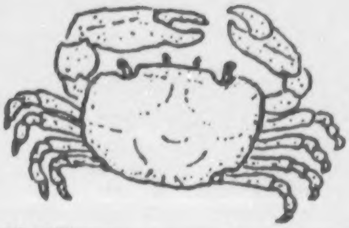
KEY WORDS

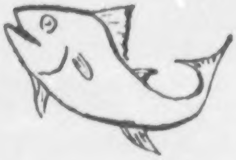
chiton
color
crabs
fish
hermit crab
pinchers
protect
seastar
starfish
swim
walk

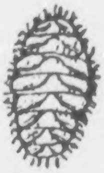
Name ______________________________

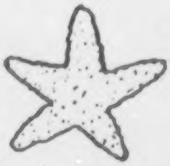
PROTECT ME!

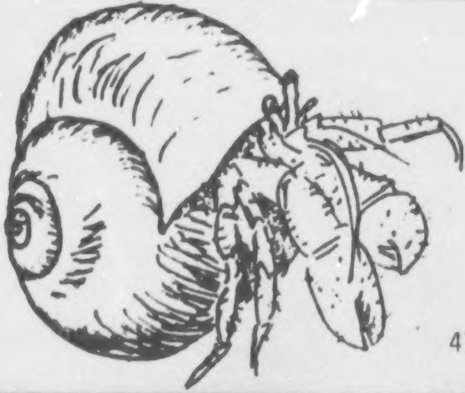
Name one way the following animals protect themselves from harm.

1. 

2. 

3. 

4. 

5. 

TEACHER BACKGROUND - Who's for Dinner?

"Who's for Dinner"? is a role playing game designed to help your students understand "Nature's Protection" and the food chain concept. Your students will play the roles of shrimp, herring and salmon. The first link in the food chain will be plankton (represented by popcorn) spread over the game area. The shrimp eat the plankton, the herring eat the shrimp and are, in turn, eaten by the salmon. The object of the game is for each animal to get something to eat without being eaten during the timed course of the game.

"Who's for Dinner"? is a poor model of nature because of the small population sizes. Natural populations are usually able to withstand the loss of some of their individuals. In our populations, the survival of any of each kind of animal will be considered a success. The community is "balanced" and will survive.

Directions:

The object for each student is to survive as an animal in a food chain by getting enough to eat while avoiding being eaten.

Materials:

4-5 liters of popped corn

clipboard and paper for results

marking pen

kitchen timer with bell

roll of 1" masking tape

1 plastic sandwich bag for each student

2 colored, 8 1/2 x 11, pieces of paper for each student (see next section)

2 safety pins for each student.

Before you are ready to being the role playing, you will need to prepare the following:

stomachs: the plastic sandwich bags will be animal stomachs. Place a strip of masking tape 4 cm from the bottom running across the bottom edge.

name tags: The colored paper will serve to identify the animals. You will need three colors: one for the shrimp, one for the herring, and the third for the salmon. Have enough of each color to allow 3/4 of the group to be shrimp, 1/3 to be herring, and 1/3 to be salmon. The fact that you have a surplus of shrimp tags will allow you to change population numbers as the game progresses. You will pin a piece of the colored paper on the front and on the back of each student.

How to play:

1. Briefly review food chains. Outline the boundaries of the game area. An area about 15 meters square is adequate. A grass area is best, but a gymnasium, a parking lot etc. will work. Outdoors missed popcorn plankton will be eaten by birds etc.
2. Spread about 3/4 of the plankton (popcorn) over the area. Tell your class you are spreading out the plankton that the shrimp will eat.
3. Hand out a plastic bag stomach and two shrimp name tags to 1/3 of your group. Tell your students to put their food (popcorn) into their stomachs when the game begins.
4. Hand out a bag and two herring name tags to a second 1/3 of the group, and bags and two salmon name tags to the last 1/3. When the game starts herring will try to capture (tag) shrimp and salmon will try to capture (tag) herring. When a herring captures a shrimp, the shrimp's stomach contents are transferred to the stomach of the herring. When the salmon captures a herring, he takes the herring's whole stomach. Note that salmon do not eat shrimp in this game.
5. State the challenge. Set the timer for five minutes and say "Go!" The first game usually lasts only a few seconds with one of two things happening. The shrimp are gobbled up before they have a chance to forage, or the herring are gobbled up and the shrimp continue to eat popcorn and get fat.
6. Analysis. How many animals survive? For a shrimp to survive, popcorn must fill the stomach bag to the bottom of the tape (4 cm). For a herring or a salmon to survive, popcorn must fill the stomach bag to the top of the tape (6 1/2 cm). If at least one of each kind of animal survives, you have an on going food chain. Return the popcorn to the activity area after each game.
7. Encore: learning by making rule variations. Ask for suggestions on rule changes that might result in more of a balance after the five minute "day" usually one rule is changed for each replay. When you have settled on your new rules, play again. Suggest these changes if your students can't offer any:
    a. change the number of shrimp and/or herring and/or salmon.
    b. Let each shrimp come back as another shrimp once after being captured and transferring stomach contents.
    c. Provide a "safety zone" for shrimp and or herring where they can be safe.
    d. Timed releases. Let shrimp go first to forage unmolested. One minute later release the herring, and later the salmon.
    e. Spread out more popcorn.

To reduce discontent over who will be which organism, draw markers from a hat to assign roles for replays.

AFTERWORD.........

Analyze the results of each game. How many shrimp got a full stomach? How many herring? How many salmon? Compare game results after each rule change and comment on how the game "balance" compares with the balance in the real world. In nature, there are more plants than plant eaters and more plant eaters than animal eaters.

Here are some questions to consider back in the classroom:

1. What would happen if there were only half as many popcorn plankton?
2. If there were no herring, what would happen to the plankton population? The shrimp population? The salmon population?
3. Do salmon need plants to survive? Explain!
4. Can you describe some food chains that you are part of?
5. Are there any plants or animals that are not part of any food chains?

Adapted from "Food Chain Game" by Outdoor Biology Instructional Strategies (OBIS), Lawrence Hall Of Science, University of California, Berkeley, California.

TEACHER BACKGROUND - Poetry

The sea has long fascinated writers and artists as well as scientists. The poems which follow are provided to inspire you to include the sea as a topic in your daily writing exercises. This is but one more way in which you can infuse your teaching with marine topics. Some of the poems are by the famous, some are by unknowns. All have something speical to say about the sea.

You may wish to read the poems to your students over the course of a few days. The poems can serve for discussion topics or for topics for art work etc. Help further the romance of the sea in your teaching.

You may elect to have your students write their own Haiku poetry. Haiku is the oldest form of Japanese poetry. Haiku poetry is an unfinished statement that presents a single thought or observation about nature. Haiku consists of three lines with a syllable count of five, seven, five.

For example:

SLEEK, GRACEFUL BLUE WHALE

HOW MOURNFUL SHINE HIS SAD EYES

SEEKING, SEEKING ME.

A similar form of poetry is called Chinquain (sin-kan). Chinquain consists of five lines, traditionally with the following form:

ONE WORD WITH TWO SYLLABLES WHICH IS THE TITLE

TWO WORDS, FOUR SYLLABLES WHICH DESCRIBE THE TITLE

THREE WORDS, SIX SYLLABLES WHICH EXPRESS FEELING

ONE WORD WITH TWO SYLLABLES WHICH IS A SYNONYM

FOR TITLE.

For example:

COLORS

RAINBOW BRIGHT

LAUGHING, WANDERING, BLOOMING

SOFT, GENTLE, COOL, REFRESHING

SHADES

Chinquain can be successfully modified to reduce the complexity. Simply use the number of words and disregard the syllable counts.

Any instruction in poetry can best be initiated through a class discussion/demonstration. Do not force your class to write. Poetry should be joyfully done - second graders are good at that! After you have elicited ideas and written a few examples on the board, let the students work in small groups on poems. Be sure to have them illustrate their poems. Display the poems on a classroom bulletin board. This can be a rewarding and enjoyable experience for all.

POEMS

Shore

Play on the seashore
   and gather up shells
kneel in the damp sands
   digging wells.

Run on the rocks
   where the seaweed slips,
Watch the waves
   and the beautiful ships.

Mary Britton Miller

The Seals

The seals all flap
   their shining flips
And bounce their balls
   on their nosey tips
And beat a drum, and catch a bear
And wriggle with
   how pleased they are.

Dorothy Aldis

In The Kelp Bed

The shellfish was so selfish
   that he wouldn't share his kelp
A weak fish was so hungry
   that he went to get some help
A porpoise leaped up happily,
   and said, "Let's be quite fair,
   there's lots of kelp around
   here and each should have
   his share.

An amberjack and herring
   swam round and took a bite.
But they all left quite suddenly.
A stingray came in sight.

Helen M. Webster

380

The Octopus

Tell me, O Octopus, I begs,
Is those things arms, or is
they legs?
I marvel at thee, Octopus!
If I were Thou, I'd call me us.

Ogden Nash

The Whale

A Whale!

Down it goes,
and more and more
Up goes its tail.

Buson

Eel - Grass

No matter what I say
All that I really love
Is the rain that flattens
on the bay
And the eel-grass in the cove.

The jingle-shells that lie and
bleach at the tide line.
And the trace of higher tides
along the beach.

Edna St. Vincent Miller

Fiddler Crabs

Their eyes on thin stalks
Peer and glare at everything
They live in small holes

Madeline Howard, (age 10)

Octopus

In the fisher's trap,
The octopus dreams a dream
Under summer moon.

Basho (translated by Alfred H. Marks)

Sea Wash

The sea wash never ends.
The sea wash repeats, repeats.
Only old songs?
   Is that all the sea knows?
   Only the old strong songs?
   Is that all?
The sea wash repeats, repeats.

Carl Sandburg

Crabs

Under the H_2o,
   close to the shore
I see two crabs walking
   across the ocean floor.

They seem in a hurry
   they run without stopping.
All business and bustle
   like ladies out shopping.

Mary E. Winchester

Sea Gull

The sea gull curves his wings
The sea gull turns his eyes
Get down into the H_2o, fish!
   (if you are wise).

The sea gull starts his wings
The sea gull turns his head
Get deep into the H_2o, fish!
   (or you'll be dead).

Elizabeth Coatsworth

YOU AND THE BEACH

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TEACHER BACKGROUND - You and the Beach

"You and the Beach" Introduces man as a factor in the interrelationships seen within the beach environment. In all likelihood, the students will someday have an opportunity to interact directly with the beach environment.

Students need to be made aware of their possible impact on a beach. While life exists under almost every rock, that life may not continue to exist if the rock gets turned upside down. The organisms are then exposed to their many predators as well as to environmental hazards such as drying by the sun.

Holes dug in the beach and left for the tide to fill also leave large numbers of organisms exposed to fight for their lives. Even empty shells serve a purpose on a beach. Man need not feel that he should not touch anything. Nature has been able to adjust to man's interaction when man has used common sense and been respectful and responsible for his actions.

The most important thing to emphasize in the course of this unit is that man is a part of nature and not apart from nature. This section gives you a chance to talk about man's role in the beach environment. Help your students to achieve the realization that man must husband nature. We must not exploit nature if we are to survive.

Duplicate the pages of the text. One set is recommended per student. The basic concepts covered in the reading need to be discussed by the teacher. Continue to be aware of new vocabulary and teach the "Key Words" if they are unfamiliar to your students. The activities included are designed to reinforce the concepts introduced. Coloring worksheets follow this Teacher Background section. They are for reinforcement. They should be used after the text has been studied.

KEY- Text questions

1. Many students will probably have been to the beach.
2. Barnacles or Limpets live on rocks.
3. When you turn over beach rocks, you should replace them.
4. Baby oysters live on empty shells.

KEY WORDS

barnacles

beach

buried

clams

crabs

effect

enemies

explore

heat

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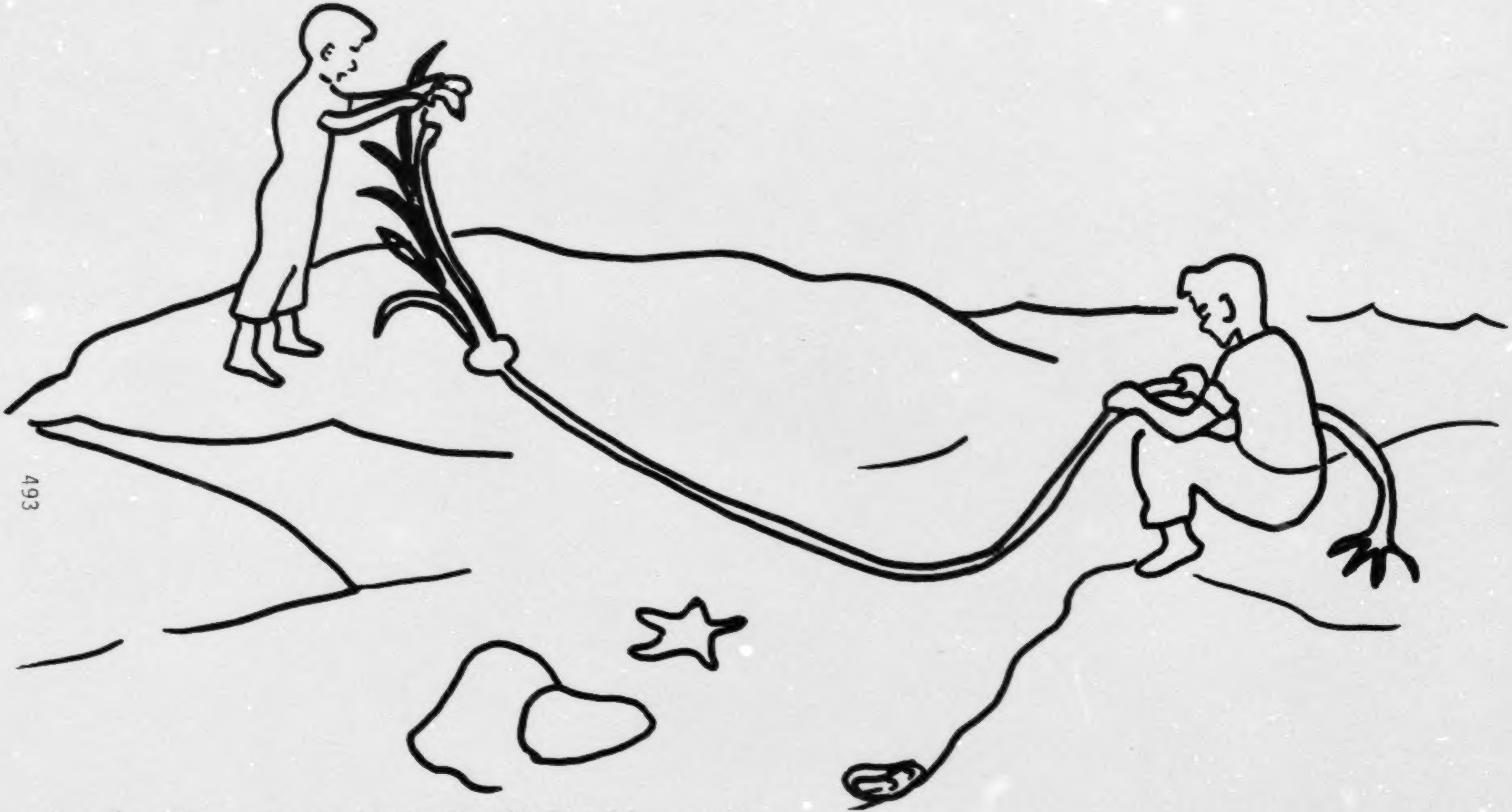
hermit crab
leave
limpets
oysters
protect
rocks
shell
summer
swim
tide
underneath
unprotected

you and the beach



493

1. Have you ever been to the beach? ______________________________

2. What did you find? ______________________________

____

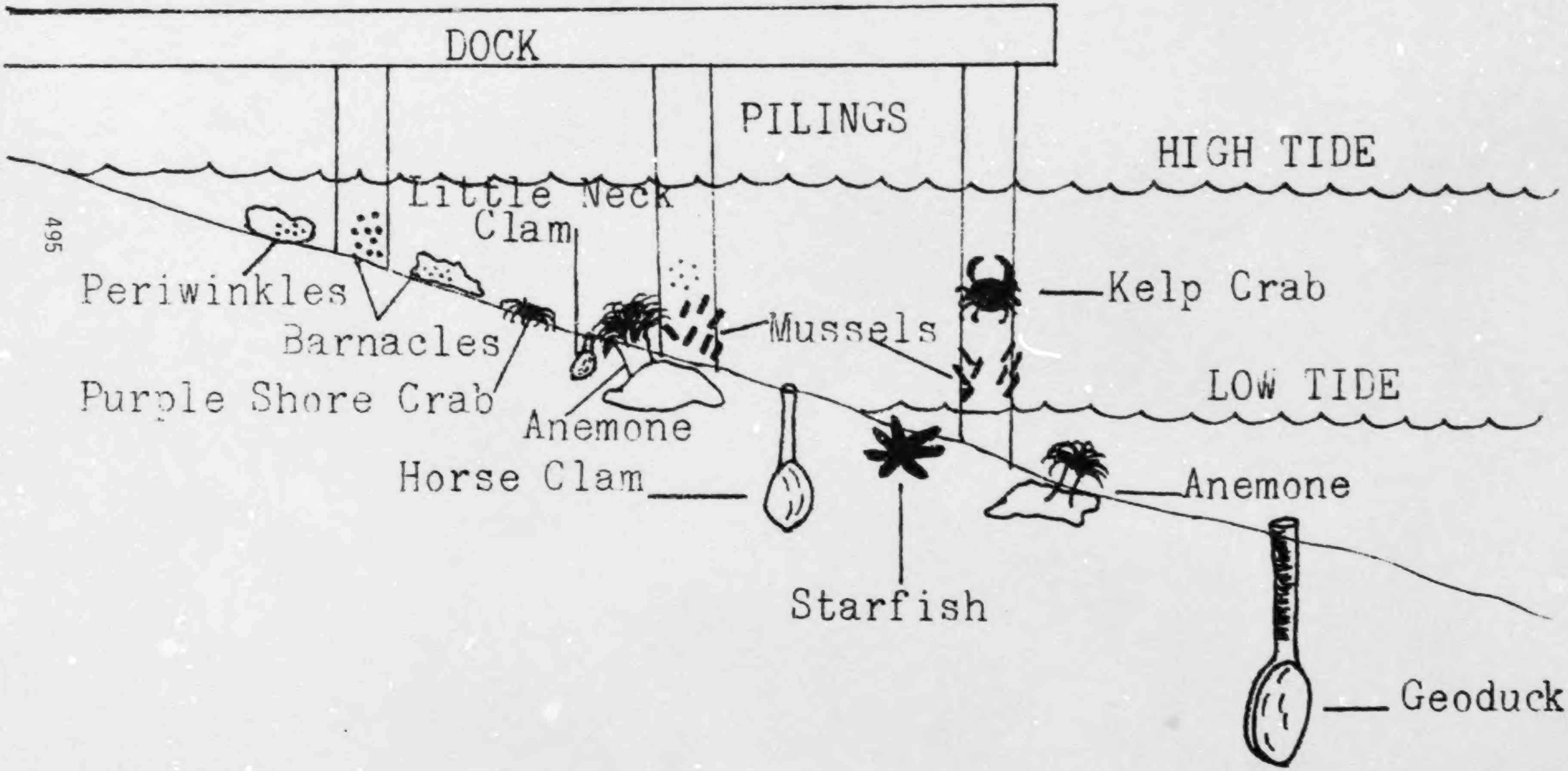
____

3. What did these boys find? ______________________________

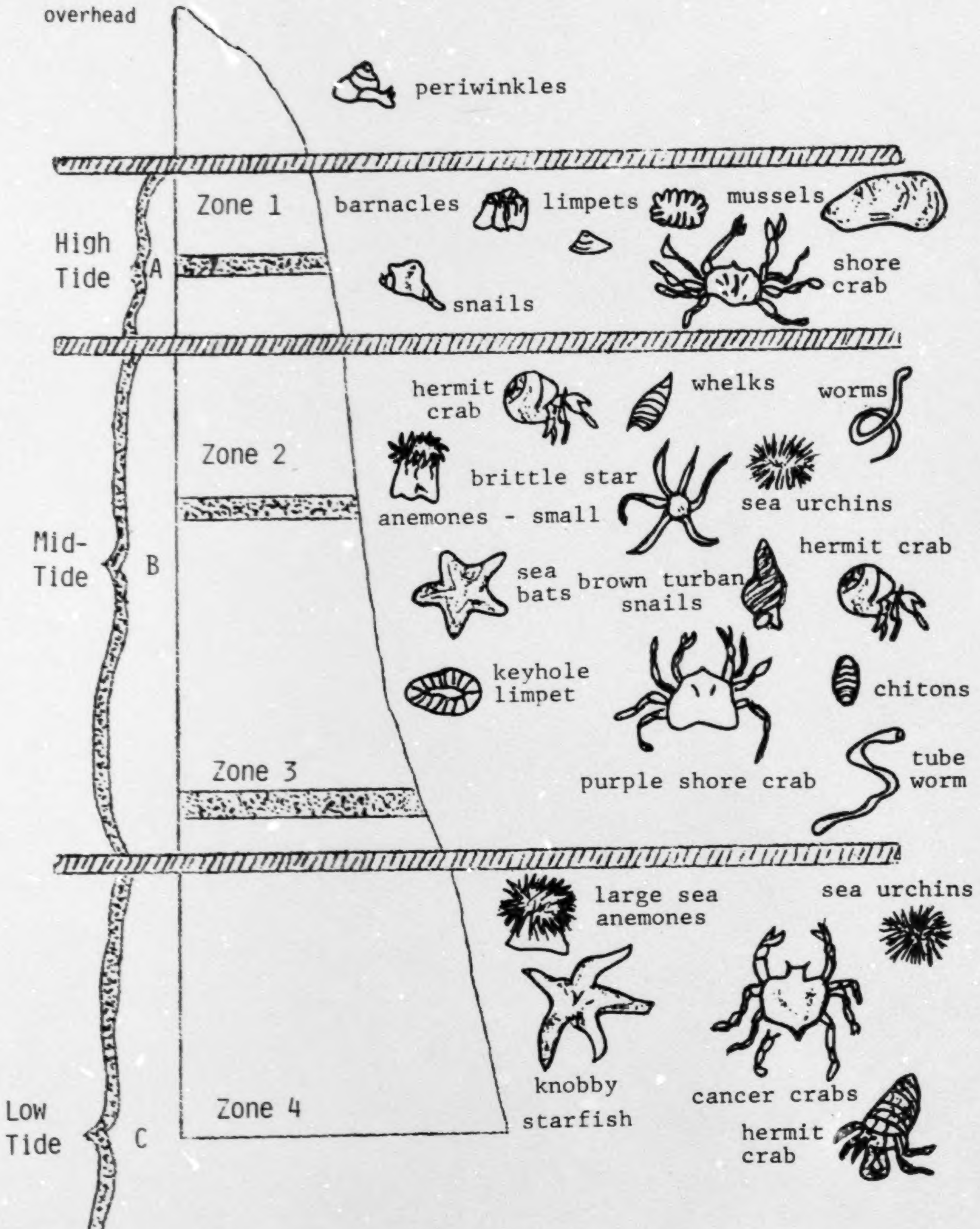
4. Color your picture.

overhead

CROSS-SECTION OF TYPICAL PUGET SOUND BEACH


DOCK
PILINGS
HIGH TIDE
Little Neck Clam
Periwinkles
Barnacles
Purple Shore Crab
Kelp Crab
Mussels
LOW TIDE
Anemone
Horse Clam
Starfish
Anemone
Geoduck

495


overhead
periwinkles
Zone 1
barnacles
limpets
mussels
High Tide
A
snails
shore crab
hermit crab
whelks
worms
Zone 2
brittle star
sea urchins
anemones - small
Mid-Tide
B
sea bats
brown turban snails
hermit crab
keyhole limpet
chitons
Zone 3
purple shore crab
tube worm
large sea anemones
sea urchins
knobby starfish
cancer crabs
Low Tide
C
Zone 4
hermit crab

Tidal Zone Diagram

Name ____________________ Page 1

YOU AND THE BEACH

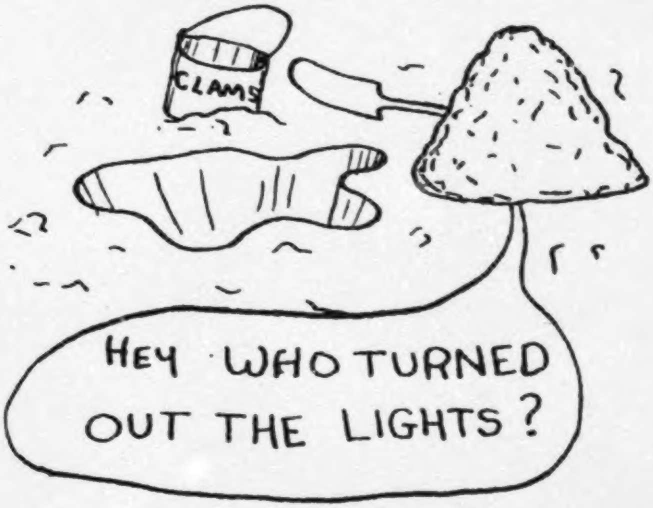
During the summer many people go to the beach. They enjoy the sun. They swim or explore the shore at low tide. People have an effect on the plants and animals. They may not realize what the effect is.

1. Have you ever been to the beach?

____

____

Digging clams at the beach is fun. Did you know that leaving the hole unfilled leaves many animals unprotected and other animals buried?


CLAMS
HEY WHO TURNED OUT THE LIGHTS?

Small animals buried by clam diggers

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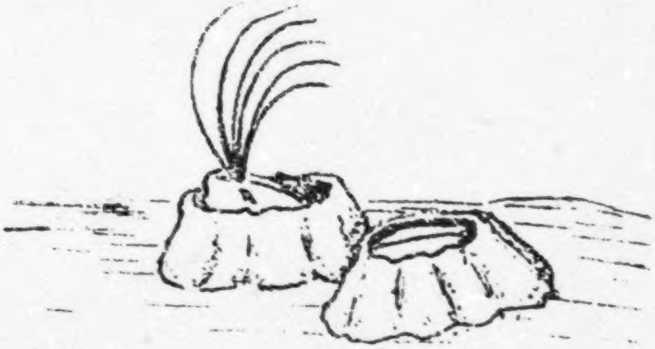
Name ______________________________

Did you know that the rocks on the beach are homes for many animals? Some of the animals live on the rocks. Barnacles and limpets live on the rocks.

2. ___________________________and ___________________________live on the rocks.



Barnacles

Other animals live underneath the rocks. Some crabs live under the rocks. What if the rock is turned upside down and not put back? All the little animals who use the rock for their home become food for their enemies. Also they are no longer protected from the sun's heat.

Name ______________________________ Page 3

3. What should you do when you turn over beach rocks? __________

____

____

An empty shell could be the home of a baby oyster. Baby barnacles also live on empty shells. It may even be the next home for the hermit crab. What if the hermit crab cannot find a new home when his old one is too small? He will not have a way to protect himself.

No shells for the hermit crab

4. Baby oysters live on empty

______________________________.

TEACHER BACKGROUND - Beach Happenings

"Beach Happenings" is creative writing.

Creative writing is designed to fulfill three educational purposes:

1. It contributes to the child's development of his powers of awareness, observation and sensitivity.
2. It contributes to the child's ability to communicate in an interesting and effective manner.
3. It develops the child's skill in using a creative approach to a task. This skill is fundamental to modern society and of particular value in a democratic society where every citizen must make decisions.

Allow the students ample time to complete the writing assignment. Help them with vocabulary etc. about which they ask, but avoid suggesting topics as much as possible.

After your students have completed their stories, discuss the picture with your class. Consider the following questions:

1. What has happened here? (Clamming has taken place).
2. What could happen here? (The holes could go unfilled. This would lead to death of the exposed and buried organisms).
3. What should happen here? (The holes should be filled by the clammer).

Volunteers can read their stories to the class. Be sure to display these stories where all can enjoy them.

KEY WORDS

beach

describe

happenings

picture

story

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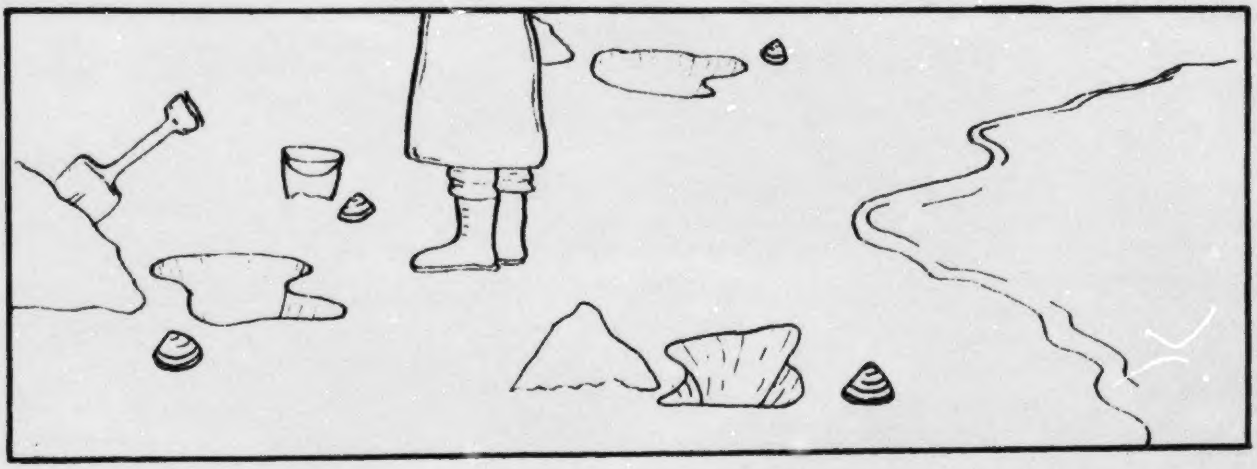
Name________________________________

BEACH HAPPENINGS



Make a story describing this picture.

TEACHER BACKGROUND - Sand Casting, Mobiles and Stabiles

"Sand Casting", "Mobiles" and "Stabiles" are three activities you may want to consider if you have access to the beach. All are easy and fun for the students. As a bonus, you get room decorations and your students will get to take some art work home (a good public relations move for your program). If you do not live near a beach, you can still do these activities with some modifications. You can use a large tray full of sand for your sand castings. You can provide mobile and stabile materials from distant beaches or nearby river banks, etc. for your class.

Be sure to allow each student to participate and to express his or her ideas. Plan to display the handiwork in your classroom before your students take their projects home.

SAND CASTING

Materials:

- plaster of Paris
- sand
- plastic bucket
- paper clips
- tagboard strips about 2" x 18"

Procedure:

1. Have students find or make prints in damp firm sand. Place shells, driftwood or rocks upside down in the sand. Press object 1/2 way into the sand.
2. Use tag board strips to make a wall around the area.
3. Mix plaster of Paris with water until it is the consistency of thick gravy. Mix only 1/2 gallon or so at one time.
4. Pour plaster into walled area. When plaster begins to set, stick paper clip in for a hanging loop. When plaster is completely set, lift from sand and carefully wipe away sand stuck on plaster.

MOBILES

Materials:

collection of beach materials
string

Procedure:

1. Tie string from each end of driftwood and attach an object to each string.
2. Tie another string to center of driftwood, which should be moved about to find a balanced position.
3. To make your mobile more complex add more tiers.

MOBILES

STABILES

Type I

Materials:

beach materials
driftwood
thread

Procedure:

1. Place a branch of driftwood in plaster of Paris or clay base so it will stand freely.
2. From each branch hang thread on which you may attach other objects from the beach.

STABILES

Type II

Materials:

beach materials
driftwood
wire (rather heavy gauge)

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Procedure:

1. Use a piece of driftwood for base. (worm wood is good, also).
2. Stick wires into driftwood and place sea objects or fish made by children on top of each wire. For interest vary height of wires.

TEACHER BACKGROUND - Beach Environmental Game

This game is used to reinforce environmental and conservation concepts. It may also be used to reinforce basic addition and subtraction skills. The "Key Words" should be taught if they are unfamiliar to your students.

The spinner can be cut out, colored, and pasted on cardboard or a block of wood. The arrow can easily be constructed with a soda straw and a straight pin. Alternatively moves may be determined by the roll of a single die. Cut out and color the animal markers.

The spinner determines the number of moves for each turn. If a contestant lands on a function square, he must follow the instructions.

The object of the game is to be the first to reach the end.

The game can be played in groups of four or less. Duplicate a sufficient number of game boards and markers to supply your class.

Be sure to have enough spinners or dice.

This game format may be used to reinforce other concepts by simply modifying the function squares.

KEY WORDS

ahead

chased

detour

environmental

predator

spaces

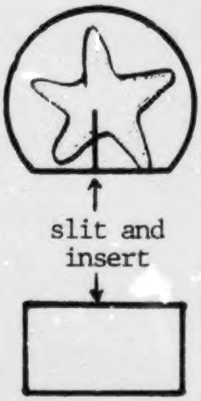
stepped on

tasty

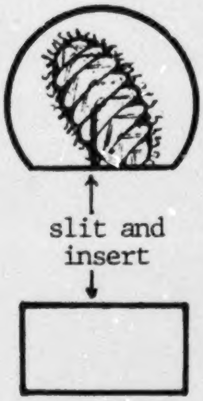
tide

wrong

cut out


slit and insert

cut out


slit and insert

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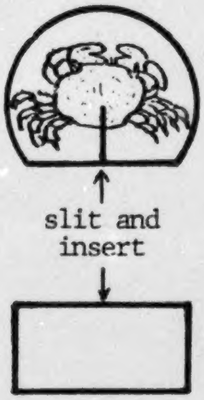
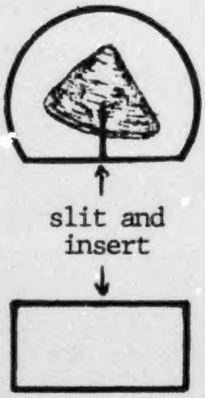
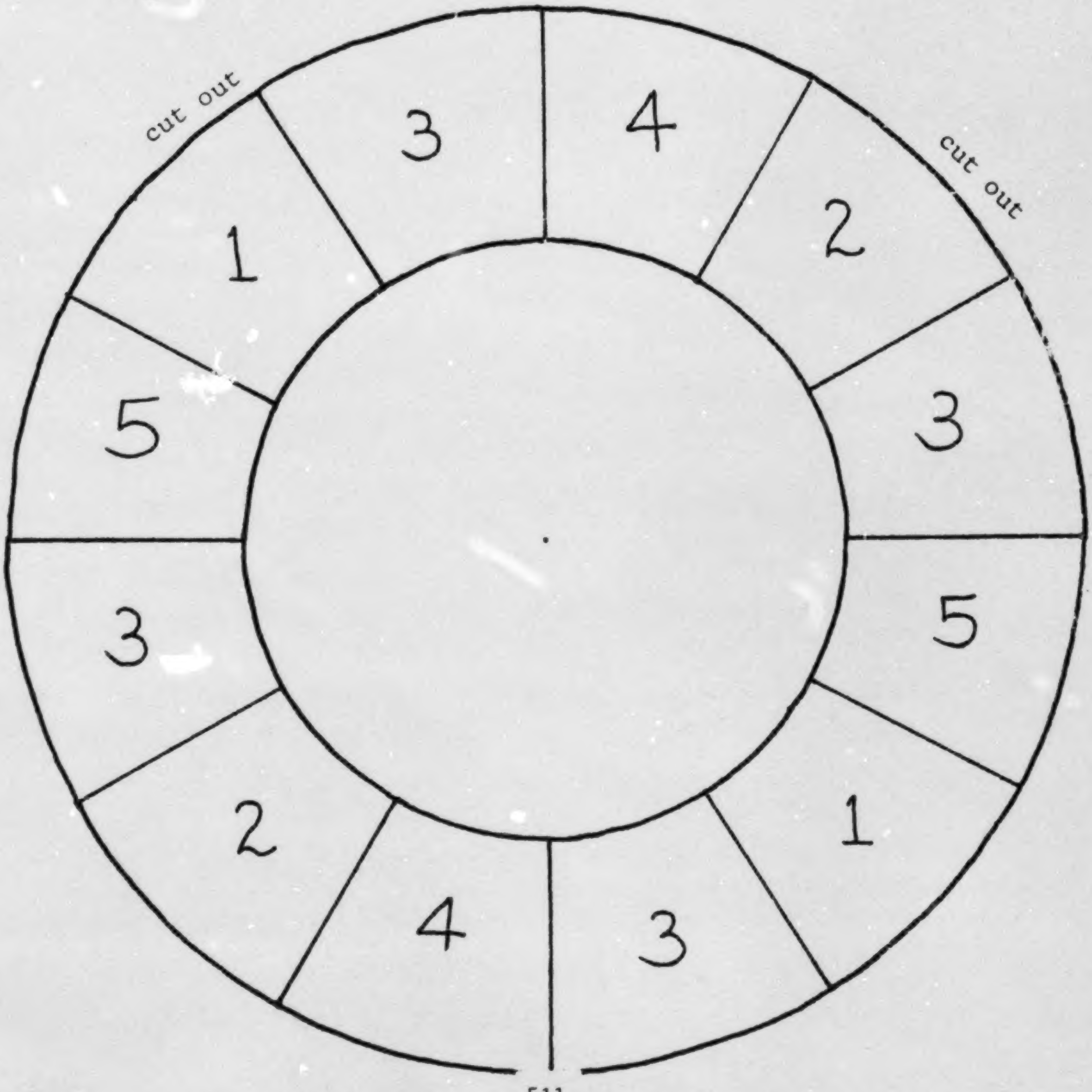
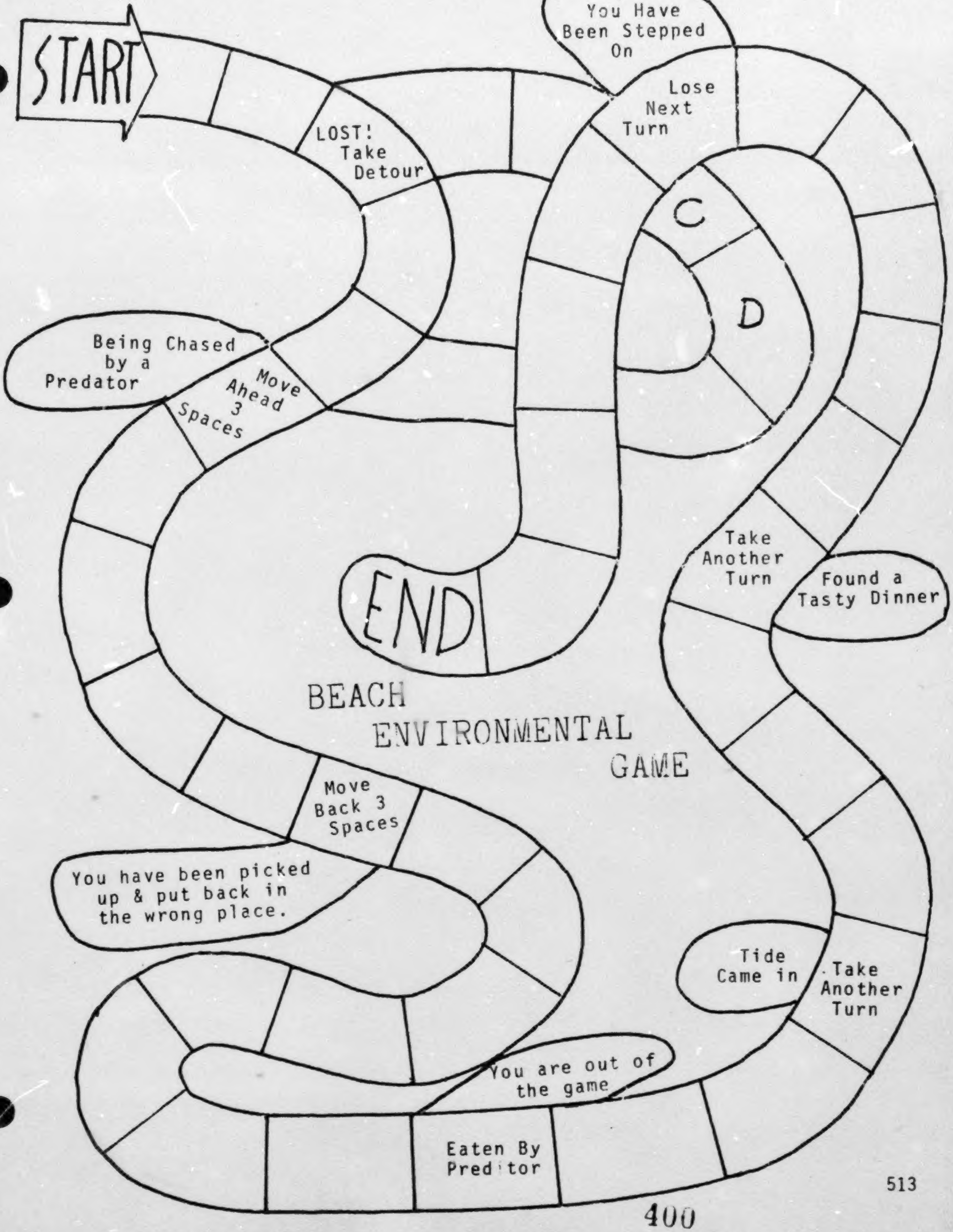

slit and insert

cut out


slit and insert


cut out

cut out
3
4
2
1
5
3
3
5
2
4
3
1


START
LOST! Take Detour
You Have Been Stepped On
Lose Next Turn
C
D
Being Chased by a Predator
Move Ahead 3 Spaces
Take Another Turn
Found a Tasty Dinner
END
BEACH ENVIRONMENTAL GAME
Move Back 3 Spaces
You have been picked up & put back in the wrong place.
Tide Came in
Take Another Turn
You are out of the game
Eaten By Preditor

DO YOUR PART

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TEACHER BACKGROUND - Do Your Part

"Do Your Part" furthers the theme introduced in "You And The Beach". This section stresses man's interactions with the beach and points out that man can have a negative effect on the beach environment.

Increasing numbers of people will result in greater use of the beaches and thus greater depletion of the marine life and more litter being deposited. Unless people use the marine environment wisely, permanent damage to the environment may occur. If our students hope to be able to enjoy a healthy marine environment in the near future, they need to join us in acting wisely. We must do more than our share to offset those who are neglectful.

Duplicate the text pages. One set is recommended per student. During the teaching of this section be aware of opportunities for creative dramatics in which students conduct body movements to show the actions of water skiing, swimming, fishing, and other beach related activities. The basic concepts covered in the reading need to be discussed by the teacher as the text questions are answered. Be aware of "Key Words". The activities included are designed to reinforce the concepts introduced. Coloring worksheets follow this Teacher Background Section. They are for reinforcement and should be used after the text has been studied.

Again, emphasize that man is a part of nature and not apart from nature. Direct the discussion to the positive things we can do to restore damaged beach environments.

KEY - Text questions

1. Litter belongs in the garbage can, not on the beach.
2. Boaters should carry litter bags and take the litter ashore. This might be a good time to discuss the philosophy we seem to have about garbage. "Out of Sight, Out of Mind". We need to recycle as much as we can both to save resources and to reduce our garbage output.

KEY WORDS

ashore

beach

bottles

clams

crabs

cut

friends

harmful

glass

litter

402

oysters

plastic

seastars

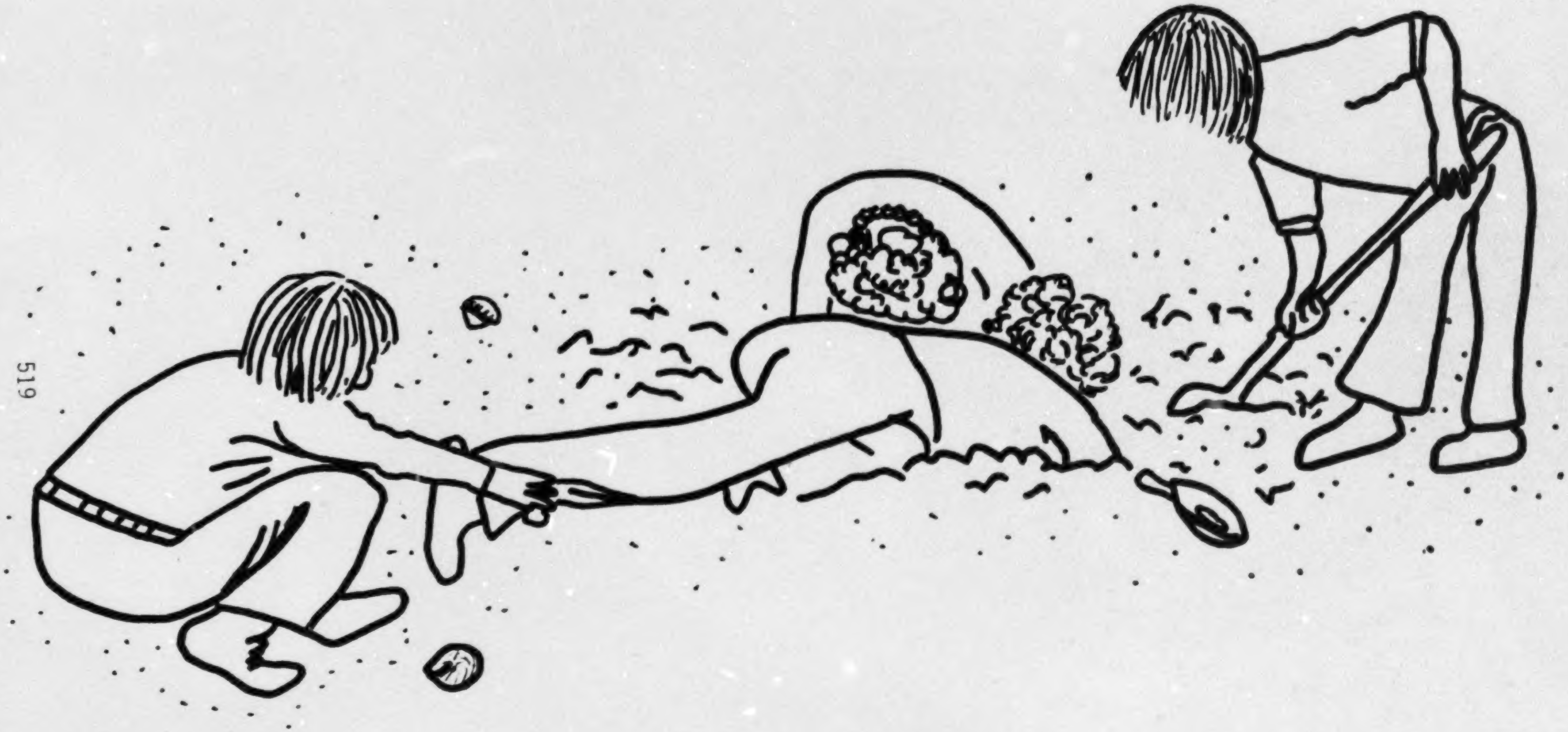
spoils

trip

unthoughtful

washed

519



Digging for clams is fun!

1. After you catch the clams you should _______________the holes.
2. Circle the bivalves.
3. Color your picture.

Name ______________________________

DO YOUR PART

Think what fun it is to go to the beach! There are so many things to do and see.

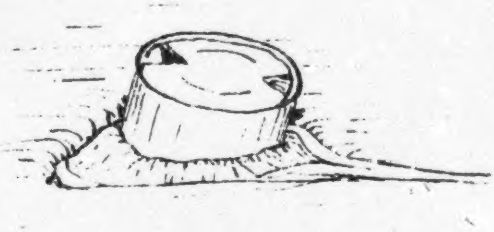
During your trip to the beach you will sometimes find litter. People leave pop cans, plastic bags, bottles and other things. Some of this litter can be harmful to the sea animals.

1. Where does litter belong?

____

____

Litter also spoils the way the beach looks. Much of this litter is washed ashore because it has been tossed overboard by thoughtless people in boats.

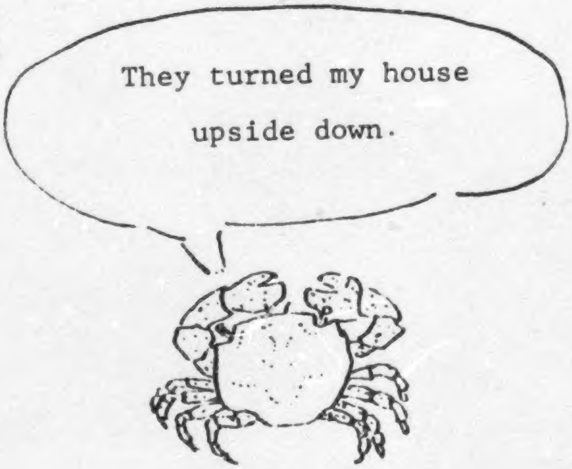


Pop can in the sand

2. What should boaters do with litter? ____________________________
____
____

Litter can be dangerous for people. People leave glass on the beach. How would you feel if you cut your foot?

After a fun day, you will go home from the beach. Remember that the crabs, sea stars, clams and oysters have homes too. Put them back close to their homes. Their homes are where you found them. Then the next time you come to the beach you will be able to find your friends again.


They turned my house upside down.

TEACHER BACKGROUND - End of the Beach?

"End of the Beach" is creative writing.

Creative writing is designed to fulfill three educational purposes:

1. It contributes to the child's development of his powers of awareness, observation and sensitivity.
2. It contributes to the child's ability to communicate in an interesting and effective manner.
3. It develops the child's skill in using a creative approach to a task. This skill is fundamental to modern society and of particular value in a democratic society where every citizen must make decisions.

Allow the students ample time to complete the writing assignment. Help them with vocabulary etc. about which they ask, but avoid suggesting topics as much as possible.

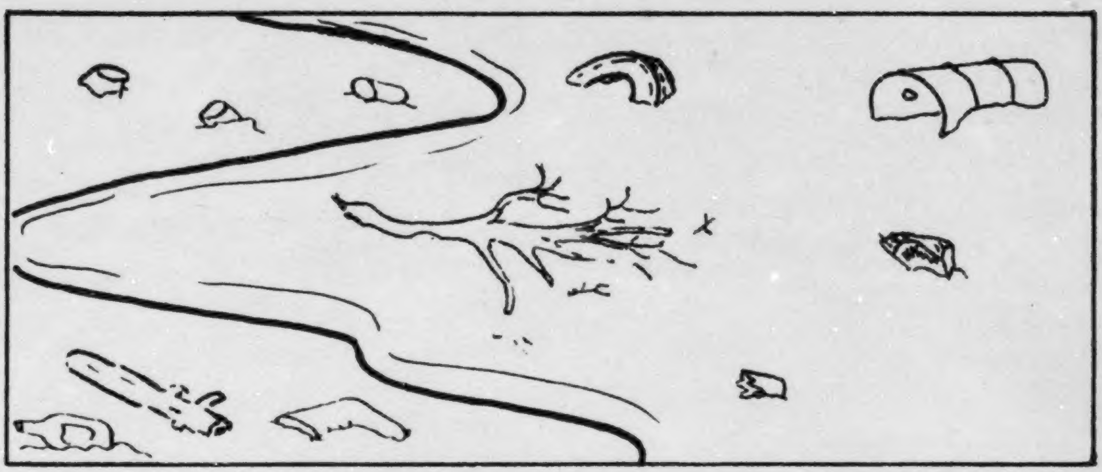
After your students have completed their stories, discuss the picture with your class. Consider the following questions:

1. What is happen ing to this beach? (The beach is being spoiled by the actions of man. The tires and other litter make the beach dangerous and unattractive. The litter also adversely affects the creatures living on the seashore).
2. What could you do to help? (To help, you can clean up the beach and see that you never add to the litter or destruction).

Volunteers can read their stories to the class. Be sure to display these stories where all can enjoy them.

Name ______________________________

END OF THE BEACH?



Write a story for this picture.

____

____

____

____

____

____

____

____

____

____

____

____

____

____

____

TEACHER BACKGROUND - Look What I Found!

"Look What I Found!"is a pre-graphing activity that reinforces the names of some of the marine animals studied. Use this activity to help students recall the animals studied and the relationships which exist between these animals.

Duplicate the "Look What I Found!" page. One set is recommended per student. Students may work on this individually or in small groups at your discretion. Be sure students understand the format. Plan to devote a few minutes after the students have completed the exercise to the discussion of the correct answers. Also plan to discuss the basic concepts covered in this activity. The "Key Words" should be taught if they are unfamiliar to your students.

KEY

1. Davey found four seastars.
2. Davey found the fewest chitons.
3. Davey found two kinds of clams.
4. Davey found twelve animals.
5. Davey found the same number of clams and sea anemone.

KEY WORDS

animal
beach
box
chiton
clam
fewest
kinds
questions
same
sea anemone
seastars

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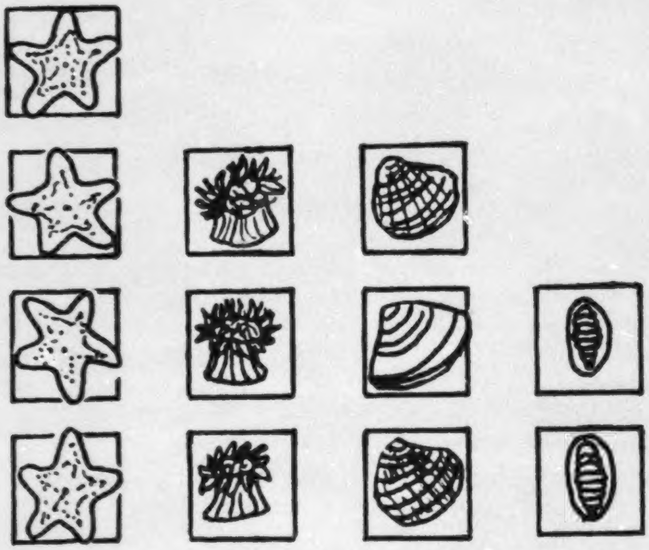
Name ______________________________

LOOK WHAT I FOUND!

Davey Jones went to the beach. He found many animals. He put each animal in a box. Look at the boxes. Then answer the questions.



1. How many sea stars did Davey find? ______________________________
2. Davey found fewest ______________________________.
3. How many kinds of clams did Davey find? ________________________
4. How many animals did Davey find? ______________________________
5. Davey found the same number
   of __________________________ and ________________________________.

TEACHER BACKGROUND - Art

Several art activities follow. These may be used to help summarize the materials covered in the unit. The activities are fun and they provide opportunities for creativity. They also provide artwork to decorate your classroom and, indeed, the entire school if so desired. Several of the activities result in a product that the student can take home. These "objects d' art" provide good publicity for what is occurring in your class.

The materials required for the various projects differ. All of the materials, however, are readily available free or for little cost.

Be sure to allow each student to participate and to express his or her ideas. Plan to display the handiwork in your classroom before your students take their projects home.

TISSUE PAPER COLLAGE

Materials:

white construction paper
tissue paper - a variety of colors
liquid starch

Procedure:

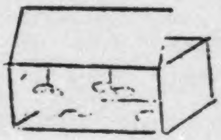
1. Have children tear pieces of tissue paper into desired shapes - seaweed animal life, rocks, etc.
2. Have children spread liquid starch on areas of construction paper and lay their torn tissue shapes down and lightly smooth them out (some creases are desirable).
3. Follow same procedure placing long strips of the tissue over the entire picture. Overlapping creates varied shades.
4. Let dry. If curled, place under weight overnight.

Materials: (see orignial) SHADOW BOX

Procedure:

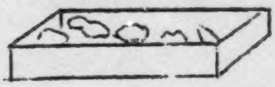
1. Measure inside of box and cut paper to be pasted to those surfaces. Decorate with crayon, paint, etc. before attaching to the sides of the box. Draw scenes appropriate for materials to be placed in the box.
2. Make pictures of sea animals out of paper and hang by string from top of box or set on the bottom.
3. Sand could be arranged in bottom.

Possible arrangements:

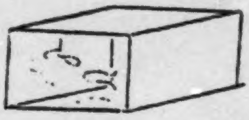


front open

objects on bottom

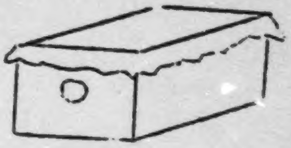


top open



end open

tissue top to allow light source



peep hole

MURALS

May be done as small group activity or entire class.

Possible subjects:

1. beach areas -- beach, high tide, low, middle, deep sea. etc.
2. food chain
3. food pyramid
4. growth changes
5. interdependency
6. conservation
7. marine life -- air, land, sea
8. favorite animals

DIRECT METHOD

Children draw directly on paper or material that will be final product. They may use paint, pencil, chalk, crayon, charcoal, etc.

INDIVIDUAL DRAWINGS

a. Children make individual drawings, paintings, etc., which are cut out, arrranged, and pasted onto class mural.

b. Using opaque projector;

1. Children make individual line drawings.

2. Drawings projected onto mural by opaque projector, adjust distance to produce desired size, trace drawing onto mural. Later children may paint or color in line drawings.

FRENCH MURAL

1. Use direct method or opaque projector method to produce mural consisting of line drawings. Use felt tip pens to produce strong outstanding lines. Keep drawings simple, avoid fine details.
2. Cut mural into pieces so that there is one per child. Be sure to number back and make a record of how they were numbered.
3. Child colors or paints his piece. He is not to be concerned about subject matter. (Some teachers find it best to limit colors to four).
4. Put back in order and paste onto butcher paper or tape pieces together.

MOSAIC

Materials:

small pebbles--several different colors
board or driftwood
string
clear household cement
pencil

Procedure:

1. Draw your design on the board. Keep it simple.
2. Apply cement to design. Work a small area at a time.
3. Place pebbles in the wet cement using different colors for different areas of the design. Let dry.
4. To hang: fasten 2 eyehooks fastened to the top of the board. Tie string through the eyehooks and hang.

HOT PLATE

Materials:

beach glass
a package of plaster of Paris
small pie pan (metal, glass or foil)
disposable container for mixing plaster of Paris
stick for stirring
cooking oil
felt or flannel
glue

Procedure:

1. Collect enough beach glass to cover the surface of the pie pan.
2. Mix plaster of Paris until it is the texture of thick gravey.
3. Grease pie pan with oil.
4. Place at least a half an inch of plaster of Paris into the pie pan. Place enough beach glass to cover the top of the plaster. Be sure to keep the surface flat.
5. Let plaster harden overnight.
6. To remove the hot plate from the pie pan, turn the pan over and tap it gently on the bottom of the pan.
7. When hot plate is completely dry, glue felt or flannel to the bottom to prevent it from scratching.

SAND LANTERNS

Materials:

large brown paper bags -- ones from the supermarket
candles
sand
matches

Procedure:

1. Turn the tops of the bags down to make a 6 inch cuff on top.
2. Place 6 inches of sand in the bottoms of the bags.
3. Place several candles in the sand well away from the sides of the bags.
4. These make interesting lanterns when lit at night for a beach party.

SAND PAINTING

Materials:

2 different colors of sand or sand and shells which have been crushed into small particles

cardboard
all purpose glue
small watercolor brush
pencil

Procedure:

1. Draw your design onto a piece of cardboard. (Do not make it too detailed).
2. Determine how you will fill in the different areas using the two different materials.
3. Mix equal amounts of glue with water (mix small amounts at a time).
4. Spread the glue on the design, working in small areas.
5. Sprinkle material one texture at a time onto the glued area. Shake off excess material.
6. Finish working with one material or texture at a time and allow time for it to dry before continuing onto the next material or texture.
7. Let it dry overnight. Frame or cover with clear plastic wrap.
8. Glue a paper clip to the back of the design in order to hang the picture if desired.

WINDOW ORNAMENT

Materials:

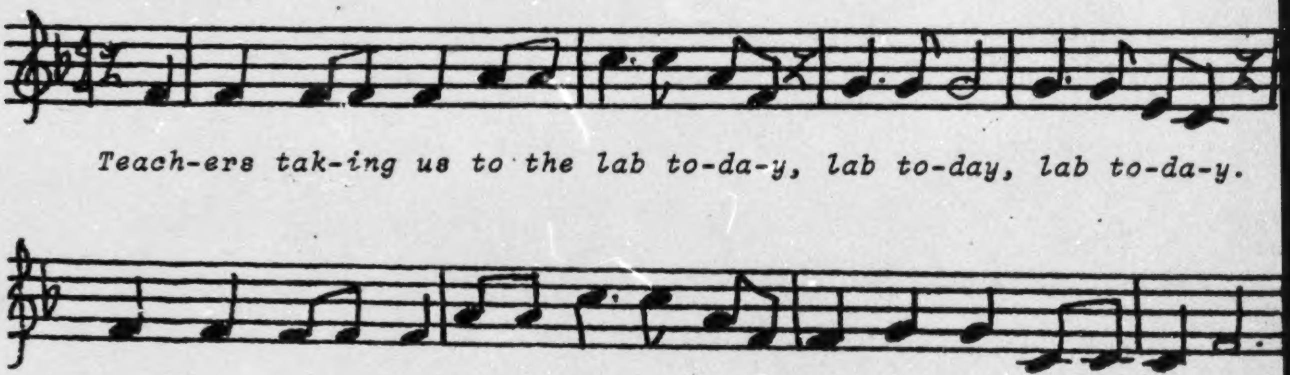
beach glass (keep the pieces small -- large pieces will fall out)
a clear plastic cover from a coffee can or other container
clear epoxy cement
tweezers
a toothpick

Procedure:

1. Punch a hole at the edge of the plastic lid to permit you to hang your ornament.
2. Place rim side up and mix the epoxy cement in it. Use the toothpick to spread it evenly.
3. Place the beach glass in the cement using the tweezers. Be careful not to get any of the cement on your hands.
4. Allow your ornament to dry thoroughly.
5. The ornament will give the same effect as stained glass.

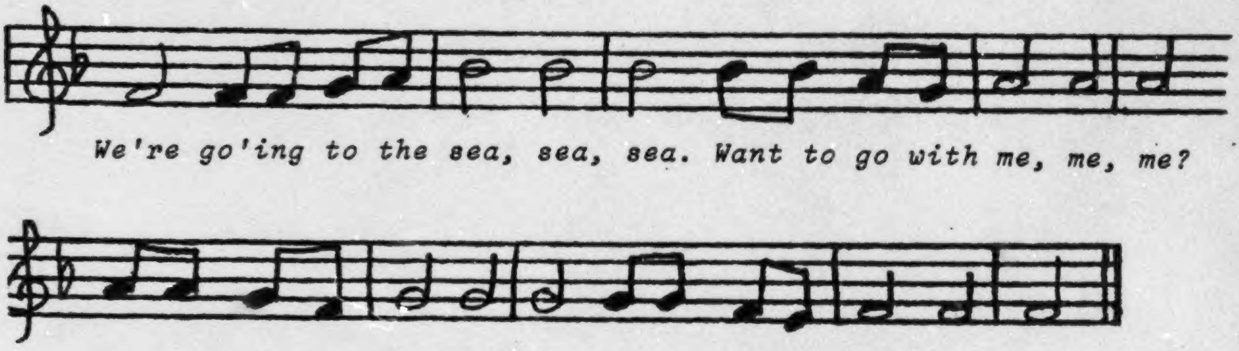
Going to the Sea

VERSE:



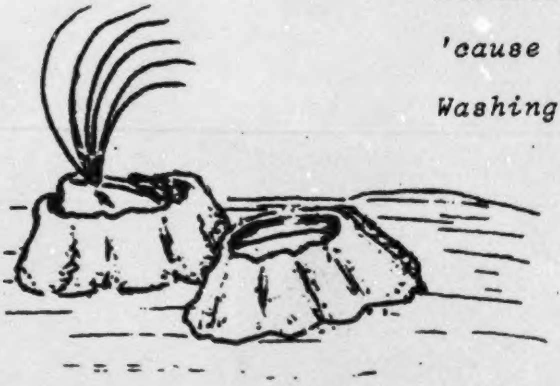
Teach-ers tak-ing us to the lab to-da-y, lab to-day, lab to-da-y.
Teach-ers tak-ing us to the lab to-da-y, and it's on Li-ber-ty Bay.

CHORUS:



We're go'ing to the sea, sea, sea. Want to go with me, me, me?
Oh what fun have we, we, we, go-ing to the sea, sea, sea

VERSE: 2
That's quite a group living on the piling,
Barnacle, mussels, and tube worms smiling,
'cause waves are high and waters riling,
Washing in the food from the sea.

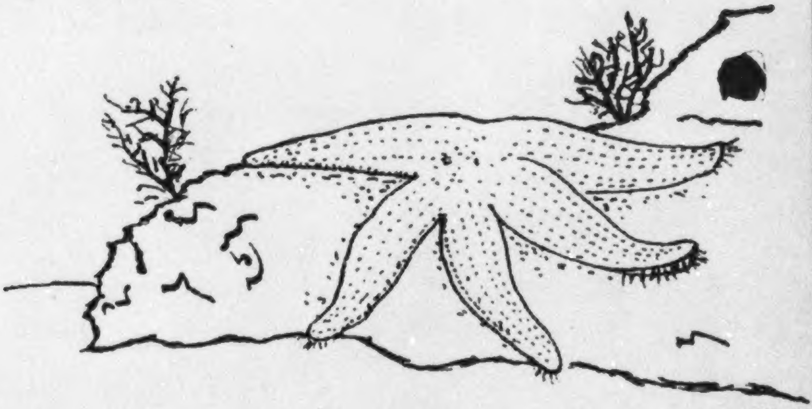


VERSE: 3

Old Mr. Crab ran side ways scooting,
His eyes are on posts and I ain't hooting,
His pinchers are tough and he'll be using,
Them in the bottom of the sea.

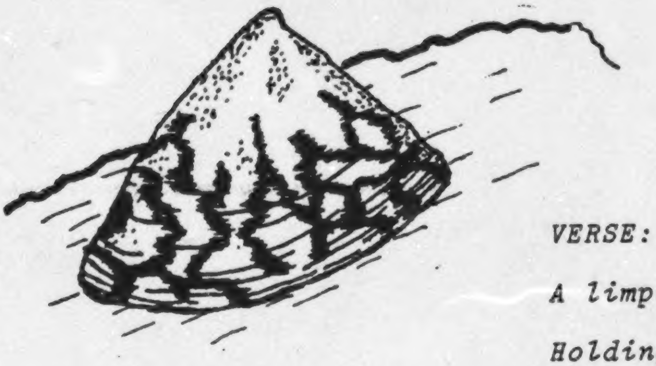
VERSE: 4

A big moon snail buried in the sand,
He's got a foot as big as your hand,
He can open any clam in the land,
Living in the bottom of the sea.



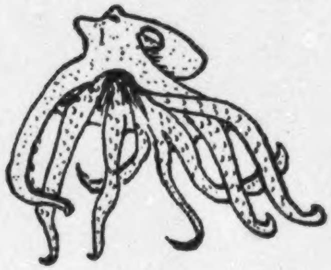
VERSE: 5

Here's a starfish with purple color,
That one's yeller, look at that feller,
He's got more arms than grand-dads umbreller.
He's happy under the sea.



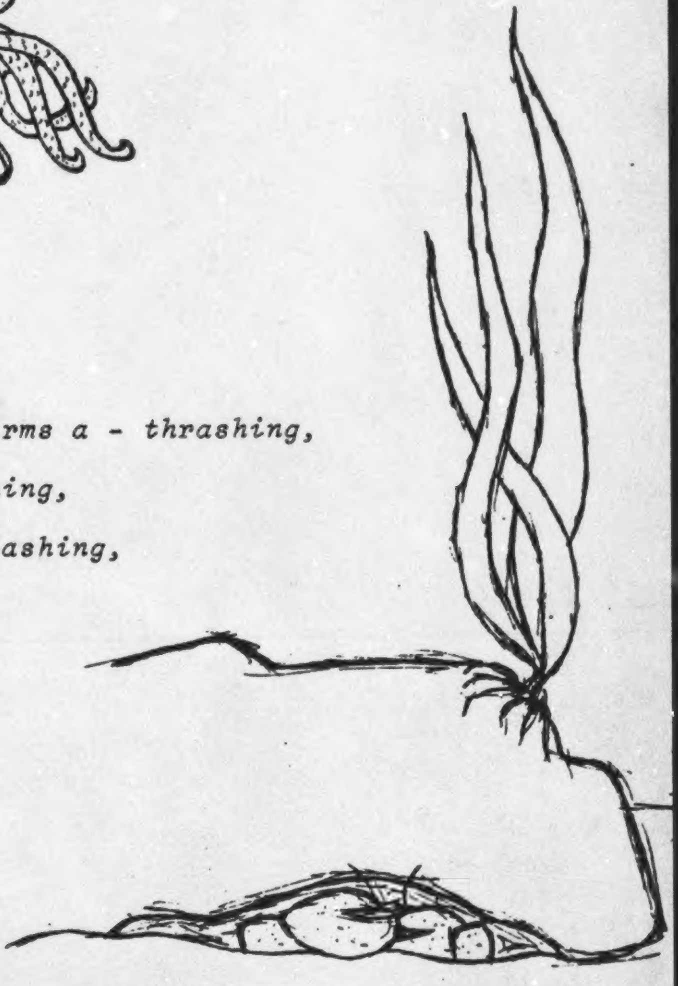
VERSE: 6

A limpet is called a Chinese hat,
Holding on to rocks where they are flat,
Eating on algae makes him fat.
Living under the sea.



VERSE: 7

First comes an octopus with arms a - thrashing,
Water splashing, ink a - dashing,
Step back kids his arms a - lashing,
To take you back to the sea.



TEACHER BACKGROUND - Marine Studies

The following page is a "diploma" designed to be awarded for successful completion of the program. You may use it for other special purposes as you see fit. The "diploma" also serves notice to your students' parents that education is indeed taking place!

MARINE STUDIES

THIS IS TO CERTIFY THAT

____

HAS SUCCESSFULLY COMPLETED THE
MARINE SCIENCE ACTIVITIES PROGRAM AND IS THEREFORE AN
HONORARY BUBBLEHEAD OF KING NEPTUNE'S REALM.

Dave Borden

Dave Borden, Director
Marine Science Center

Marine
Science
Center

SEND - IN PAGE

Well, you've made it. Thank you for teaching about the marine environment. We worked hard to put this unit together and we would really like to hear from you. If you have any reactions (positive or negative) that could help us, please let us know. We are also interested in any changes you made in the activities which you feel made them more useful. If you have some marine activities that you have tried successfully with children, we would like to know about them also. Perhaps we can help you share your working ideas with other teachers concerned with the marine environment. Again thanks, and keep up the good work.